

RELATIONSHIPS AMONG BILINGUALISM,
CRITICAL THINKING ABILITY,
AND CRITICAL THINKING DISPOSITION
OF BACCALAUREATE NURSING STUDENTS

By

RAYMOND T. ALBERT

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1996

Copyright 1996

by

Raymond T. Albert

This dissertation is
dedicated to my parents,
Fernand and Rita Albert,
my wife, Rachel Albert,
and my children,
whose love and support
made it possible.

ACKNOWLEDGEMENTS

Many people, including family and friends, have provided encouragement and support that enabled me to complete this dissertation. I extend my deepest gratitude to all of them. I wish to especially thank those directly involved in the completion of the study.

Each member of the supervisory committee has helped in his own way. I am grateful to Dr. M. David Miller for his scholarship and quantitative analysis expertise, Dr. Jeffry A. Hurt for his rigorous attention to academic standards, Dr. C. Arthur Sandeen for his thoughtful words and genuine interest, and Dr. Craig L. Frisby for his scholarship and literary research wisdom.

I wish to express a very special word of appreciation to Dr. Lee J. Mullally, supervising professor of this dissertation. His assistance throughout the doctoral program significantly contributed to the completion of this very real academic goal.

I am also very grateful to each of the students who participated in the study as well as for the assistance and encouragement received from study site administrators Penny Ericson, Michelle Trudeau, France Marquis and Vincent Pelletier.

Finally, I particularly want to thank my parents, wife and children. Their sacrifice and support throughout my life made it possible for me to achieve this goal.

TABLE OF CONTENTS

	<u>page</u>
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
ABSTRACT	ix
CHAPTERS	
1 INTRODUCTION	1
Statement of the Problem	2
Need for the Study	4
Theoretical Basis	9
Research Questions	11
Assumptions	12
Definition of Terms	12
Summary	14
2 REVIEW OF THE LITERATURE	15
Introduction	15
Cognitive Functioning in Bilinguals	15
Bilingualism and Critical Thinking Ability	21
Bilingualism and Critical Thinking Disposition	25
Language Interdependence in Bilinguals	28
Critical Thinking Ability and Disposition in Nursing Students	32
Thought and Language	35
Threshold Hypothesis	37
Summary	40

3 DESIGN AND METHODOLOGY	42
Introduction	42
Study Design and Procedures	42
Population and Sample	44
Instrumentation	45
Data Collection	56
Data Analysis	57
Summary	59
4 FINDINGS	60
Introduction	60
Setting and Subjects	61
Demographic Characteristics of Sample	61
Subject Performance on Research Instruments	63
Analysis of Data	64
Tests of Hypotheses	66
Summary	73
5 SUMMARY AND DISCUSSION	74
Overview	74
Summary of Research Problem and Method	74
Interpretation of Results	77
Limitations of Study	86
Implications for the Field of Education	88
Recommendations for Further Research	92
APPENDICES	
1 DEMOGRAPHIC DATA QUESTIONNAIRE	96
2 C-TEST English Version	99
3 C-TEST French Version	104
4 REQUEST FOR STUDY RESULTS	109
REFERENCES	110
BIOGRAPHICAL SKETCH	117

LIST OF TABLES

<u>Table</u>		<u>page</u>
1	Frequency Distribution of Sample by School	61
2	Frequency Distribution of Sample by Gender	62
3	Demographic Characteristics of Sample	63
4	Subject Performance on Test Instruments	65
5	Statistical Tests of Hypotheses	71

LIST OF FIGURES

<u>Figure</u>		<u>page</u>
1	Cummins' (1981) linguistic interdependence model	30
2	Cognitive effects of different types of bilingualism	39
3	Relationship between bilingualism and critical thinking disposition predicted by Diaz's (1985) <i>new threshold hypothesis</i>	82
4	Relationship between bilingualism and critical thinking disposition as predicted by findings of present study.	83

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

RELATIONSHIPS AMONG BILINGUALISM,
CRITICAL THINKING ABILITY,
AND CRITICAL THINKING DISPOSITION
OF BACCALAUREATE NURSING STUDENTS

By

Raymond T. Albert

December 1996

Chairman: Dr. Lee J. Mullally

Major Department: Instruction and Curriculum

Evidence exists supporting relationships between bilingualism and many cognitive factors. Evidence also exists supporting the importance of critical thinking ability and critical thinking disposition as essential characteristics of practicing professional nurses. Research, however, has heretofore not been conducted to specifically examine the relationships among bilingualism, critical thinking ability, and critical thinking disposition of baccalaureate nursing students.

This cross-sectional study employed a pooled within bilingual correlational design to examine such relationships. Specific research questions posed were as follows: (1) Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability? (2) Is there a statistically significant

curvilinear relationship between bilingualism and critical thinking disposition? (3) Is there a statistically significant relationship between critical thinking disposition and critical thinking ability?

The sample consisted of 111 nursing students enrolled in four baccalaureate nursing programs serving populations characterized by varying degrees of bilingualism. Subjects were administered an investigator designed demographic data instrument, a French language C-Test, an English language C-Test, as well as the California Critical Thinking Skills Test, and the California Critical Thinking Disposition Inventory.

Multiple regression analysis was employed to test the hypotheses corresponding to the existence of relationships among the three constructs. Findings failed to provide sufficient evidence to support the existence of a relationship between either bilingualism and critical thinking ability, or between critical thinking disposition and critical thinking ability. The findings did provide sufficient evidence to support the existence of a curvilinear relationship between bilingualism and critical thinking disposition which supports Cummins' threshold hypothesis.

This study's findings suggest that a better understanding of the relationships among bilingualism, critical thinking ability, and critical thinking disposition leads to a better understanding of the learner. Through an improved understanding of the learner more effective instruction may be designed.

The need was identified for further research to explore the nature of the relationships particularly across populations characterized by varying degrees of age, academic preparation, socio-cultural background, and bilingual proficiency in different

language combinations. Further studies may explore how such relationships influence instructional effectiveness particularly of critical thinking instruction.

CHAPTER 1 INTRODUCTION

The goal of the study was to determine if relationships exist among bilingualism, critical thinking ability, and critical thinking disposition of baccalaureate nursing students. Based upon both theory and empirical research findings it was expected that positive relationships were to be uncovered between bilingualism and critical thinking ability, between bilingualism and critical thinking disposition, and between critical thinking disposition and critical thinking ability. The study's findings have theoretical application by supporting Cummins' (1979a) threshold hypothesis as well as the theory of the relationship between language and thought posited by Whorf (1956). The primary focus of the present study, however, was testing Cummins' (1979a) threshold hypothesis in a new situation. In addition, the present study's findings have practical application by suggesting that a better understanding of the relationships among bilingualism, critical thinking ability, and critical thinking disposition leads to a better understanding of the learner. Through an improved understanding of the learner more effective instruction, curricula, and accreditation criteria may be designed.

Statement of the Problem

This study examined bilingualism, critical thinking ability, and critical thinking disposition of baccalaureate nursing students. The problem this study addressed was the determination of the existence of relationships among these three constructs.

Although studies which were conducted during the first half of this century to examine the relationship between bilingualism and general intelligence yielded contradictory findings, numerous methodological weaknesses of the studies have subsequently been identified as contributing greatly to the lack of consensus on the cognitive effects of bilingualism. Following the lead established by a landmark study conducted by Peal and Lambert (1962), studies have since been better designed and as a result have more consistently yielded evidence in support of numerous cognitive advantages being associated with bilingualism. Bilingualism has been shown through numerous research studies to be related to cognitive factors which have in turn been shown to correlate with intelligence (e.g., divergent thinking skill, field independence, concept formation, cognitive flexibility) (Bain, 1974; Balkan, 1970; Ben-Zeev, 1977; Carringer, 1974; Cummins, 1978; Duncan & DeAvila, 1979; Feldman & Shen, 1971; Gunning, 1981; Ianco-Worrall, 1972; Landry, 1974; Liedtke & Nelson, 1968; Peal & Lambert, 1962; Torrance, Gowan, Wu, & Aliotti, 1970;).

Although the relationships among bilingualism, critical thinking ability, and critical thinking disposition have yet to be fully elucidated, a substantial case can be built in support of the existence of such relationships. A consensus as to the conceptualization of critical thinking ability and critical thinking disposition has only

recently been achieved (Facione, 1990), and as a result the potential for uncovering such relationships has only recently reached an adequate level. The critical thinking construct is quite complex, and one's ability to think critically can be viewed as being dependent upon many of the same factors that have been shown to be positively correlated with bilingualism. Evidence in support of the existence of relationships among bilingualism, critical thinking ability, and critical thinking disposition has therefore often been based indirectly on constructs which have heretofore received greater attention (e.g., intelligence).

In perhaps one of the most influential earlier works on critical thinking ability, Watson and Glaser (1980) reported the correlation between the relatively widely used Watson-Glaser Critical Thinking Appraisal (WGCTA) and various intelligence measures to be quite high (.55 to .75). They concluded that "a high level of intelligence as measured by conventional tests may be necessary, but not sufficient, for high attainment in critical thinking" (p. 10). Factor analytic studies of various critical thinking measures have additionally shown the following four factors to be quite pronounced; general reasoning ability, logical discrimination/application of logic principles, semantics/verbal understanding (perhaps related to sophistication in language use), and grade point average (Facione, 1990; Rust, Jones, & Kaiser 1962). Thus, just as the relationship between bilingualism and many cognitive factors associated with intelligence has been empirically established, so too has the relationship between intelligence and critical thinking ability.

In summary, bilingualism has been empirically shown to be positively correlated with numerous cognitive factors which have in turn have been linked to critical thinking ability and disposition. Based on such empirical evidence, positive relationships between bilingualism and critical thinking ability and between bilingualism and critical thinking disposition were expected to be uncovered. Additional theory-based support for the existence of such relationships can be found in the theories of Whorf (1956) and Vygotsky (1934/1962) and most especially in Cummins' (1979a) threshold hypothesis which forms the theoretical framework for the study.

Need for the Study

Support for the theoretical as well as the practical significance of this study is based upon numerous factors. The theoretical significance of the study is primarily based on the role the findings play in supporting Cummins' (1979a) threshold hypothesis. The study's theoretical significance is also based on the role the findings play in supporting Whorf's (1956) and refuting Vygotsky's (1934/1962) theories of the relationship between language and thought. The practical significance of the study, while being of secondary interest, rests with future research efforts aimed at the development of more specific baccalaureate nursing accreditation criteria, better baccalaureate nursing curricula, and more effective baccalaureate nursing critical thinking instruction.

In attempting to reconcile the contradictory findings produced by studies which have attempted to examine the relationships among bilingualism and various cognitive functioning factors, James Cummins (1976) theorized that positive cognitive effects--believed to correspond to additive bilingualism--were only realizable once a person had attained a certain threshold or minimal competence level of bilingual proficiency. Cummins (1976) further theorized that prior to crossing the threshold the person is unlikely to garner any of the positive cognitive effects (e.g., enhanced metalinguistic awareness) shown by numerous studies to be related to bilingualism. Cummins (1979a) later elaborated on his threshold hypothesis and argued that there also exists a second, lower, threshold of bilingual proficiency which a person must attain in order to avoid the negative cognitive effects (e.g., linguistic interference) shown by earlier studies to be related to bilingualism. While such earlier studies tended to yield findings which supported what was commonly referred to as a *language handicap*, their basic research methodologies have since been shown to be replete with flaws.

Many prominent scholars have sought to reveal the more general relationship between language and thought. Among them are Benjamin Whorf and Lev Vygotsky. Whorf's (1956) theory of the relationship between language and thought, although not well defined, has received a great deal of attention. Many have argued that Whorf's notion of *linguistic determinism* can be viewed either as absolutely deterministic (i.e., language solely determines thought) or as a tendency (i.e., language contributes in subtle ways to shaping thought). Although Whorf failed to be specific in describing his theory of the relationship between language and thought, it has proven to be

exceedingly difficult to refute the possibility that one's thought processes have a tendency to operate along language dependent lines and as such provide a wider range of thought to the bilingual. Vygotsky (1934/1962), who was particularly interested in the speech that children directed toward themselves when attempting to solve problems, argued that a person's language eventually becomes a medium for organizing thought and ordering the components of its abstract symbol system. Vygotsky (1978) distinguished a special form of speech--which he referred to as *egocentric speech*--from *social speech* which a child uses when communicating ideas. Vygotsky argued that the bilingual should be more facile than the monolingual in cognitive processing as a result of their superior command of language. Thus, as the present study has a basis in theory similar to the theories posited by Whorf and Vygotsky, its findings--in addition to providing support or opposition to Cummins' (1979a) threshold hypothesis--undoubtedly also will lend support or opposition to the respective theories of these two scholars.

The practical significance of the study, while being of secondary interest, rests with the findings contributing to future research efforts. Future research efforts based on the present study's findings will likely lead to a better understanding of the cognitive and linguistic factors influencing the effectiveness of baccalaureate nursing critical thinking instruction, curricula, and accreditation criteria. Research efforts aimed at achieving a better understanding of the cognitive and linguistic factors influencing such instruction and curricula will clearly benefit from a better understanding of the relationships among bilingualism, critical thinking ability, and

critical thinking disposition. The significance of the study's practical contribution can perhaps best be realized through an appreciation of the value our society has placed on the ability to think critically. Since the early 1950s, proposals have offered to establish critical thinking as a goal of education (Dressel, 1955; National Commission on Excellence in Education, 1983; National Institute of Education, 1984; Newman, 1985). Many professional accrediting agencies, such as the National League for Nursing (NLN), have followed suit and have specifically identified critical thinking ability as an essential element of any program wishing to be accredited. Although the NLN's accreditation criteria for critical thinking instruction are currently defined in only very general terms, it is likely their definition will evolve to become more specific. Enhanced criterion specificity will be made possible, in part, through a better understanding of the relationships among bilingualism, critical thinking ability, and the critical thinking disposition of baccalaureate nursing students. The enhancement of accreditation criteria will likely contribute in turn to the development of better baccalaureate nursing curricula.

Many education scholars have argued that instructional effectiveness may be increased via a better understanding of the characteristics which each learner presents to the instructional setting. Conversely, instructional effectiveness may diminish when important learner characteristics are ignored by the instructional designer. According to Mullally (1979), "In order to effectively design instruction and maximize learning, educators should recognize and respect the learner as an individual. In addition to analyzing student characteristics relating to academic or social factors, educators

should be determining how an individual seeks meaning" (p. 238). How an individual seeks meaning is likely influenced by the culture in which the person has been brought up. Whorf (1956), hypothesized that speakers of different languages have different patterns of thought. Some have argued that it is possible to view the weak form of Whorf's hypothesis as suggesting that ". . . the bilingual is a happy thinker. Any given problem can be handled through two linguistic systems, and the languages can be alternated in search of the one that would more efficiently guide thinking" (Hakuta, 1986, p. 77). In light of such a view, it is easier to imagine how attention to learner characteristics as part of the instructional design process can dramatically influence the effectiveness of critical thinking instruction.

Many educators today justifiably view with great skepticism the effectiveness of critical thinking instruction. Follman (1987) argues that critical thinking is difficult to teach. This difficulty is particularly evident when examining the effects of contemporary critical thinking skills training programs originating between 1983 and the present (Keller, 1993). Failure to consider essential learner characteristics may have contributed to the mixed findings of many of the studies which have attempted to determine the effectiveness of various forms of critical thinking instruction incorporated into baccalaureate nursing curricula (Gross, Takazawa, & Rose, 1987; Kintgen-Andrews, 1988). Thus, in conjunction with the present study's findings, future research efforts will likely result in the establishment of more effective critical thinking instruction and better baccalaureate nursing curricula.

Theoretical Basis

The earliest studies involving bilingualism tended to yield support to the notion of bilingualism having a detrimental influence on numerous cognitive factors (Barke & Perry-Williams, 1938; Carrow, 1957; Harris, 1948; Saer, 1923). Findings resulting from more recent studies, however, have yielded support to the notion of bilingualism being associated with enhancements in such cognitive functioning factors as divergent thinking skills (Carringer, 1974; Landry, 1974; Torrance, Gowan, Wu, & Aliotti, 1970), field independence (Duncan & DeAvila, 1979), concept formation (Bain, 1974; Liedtke & Nelson, 1968), linguistic and metalinguistic awareness (Cummins, 1978; Feldman & Shen, 1971; Ianco-Worrall, 1972), and cognitive flexibility in terms of both verbal and spatial ability tasks (Balkan, 1970; Ben-Zeev, 1977; Landry, 1974; Peal & Lambert, 1962).

Cummins (1976), among others, recognized the contradiction between the findings of earlier studies and those of later studies. In establishing a framework for the interpretation of the seemingly inconsistent findings, Cummins (1976) reviewed the relevant literature and attempted to isolate those factors which differentiated the two types of studies. Upon completing his review, Cummins (1976) formulated the following hypothesis:

There may be a threshold level of linguistic competence which a bilingual child must attain both in order to avoid cognitive deficits and allow the potentially beneficial aspects of becoming bilingual to influence his cognitive functioning. (p. 3)

Further attempts to resolve the inconsistent findings of past studies combined with the published research findings of Toukomaa and Skutnabb-Kangas (1977) and

others eventually led Cummins (1979a) to supplement the threshold hypothesis. Upon establishing the existence of a second lower threshold of linguistic competence, Cummins (1979a) restated the threshold hypothesis as follows:

The attainment of a lower threshold level of bilingual competence would be sufficient to avoid any negative cognitive effects; but the attainment of a second, higher, level of competence might be necessary to lead to accelerated cognitive growth. (p. 230)

Cummins' (1979a) threshold hypothesis indicates two slope transition points in the relationship between bilingualism and cognitive growth. The threshold hypothesis made possible an explanation of the inconsistent findings by allowing one to argue that studies reporting detrimental cognitive effects being associated with bilingualism had probably involved subjects who had not attained the lower threshold of bilingual competence. Similarly, the threshold hypothesis allowed one to argue that studies reporting positive cognitive effects being associated with bilingualism had probably involved subjects who had attained both the low and upper threshold levels of competence. Overall, the establishment of Cummins' (1979a) threshold hypothesis contributed greatly to an explanation of the inconsistent findings reported by past studies.

In addition to the threshold hypothesis, Cummins (1979a) identified several methodological factors which were believed to have further contributed to the inconsistent findings. Included among the factors was the inability of researchers to use random assignment to language development groups as a means of limiting the confounding influence of uncontrolled group differences. In attempting to address the methodological weaknesses associated with nonrandom assignment to language

development groups, Diaz (1985) operationalized bilingual proficiency as proficiency in a second language, and called for the use of multiple regression analysis in the determination of relationships among constructs. Instead of utilizing a between group analysis design involving several different language proficiency groups, Diaz (1985) utilized a within bilingual group analysis design which involved degree of second language proficiency in a multiple regression analysis. In so doing, Diaz(1985) addressed a significant methodological weakness suffered by past studies which is believed to have contributed to their inconsistent findings.

This study tests Cummins' (1979a) threshold hypothesis in a new situation by determining the existence of relationships among bilingualism, critical thinking ability, and critical thinking disposition of baccalaureate nursing students. More specifically, the present study tests Cummins' (1979a) threshold hypothesis through the determination of the existence of curvilinear relationships between bilingualism and critical thinking ability, and between bilingualism and critical thinking disposition of baccalaureate nursing students.

Research Questions

To address the problem, the investigator proposed to find answers to the following research questions:

1. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability?

2. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition?
3. Is there a statistically significant relationship between critical thinking disposition and critical thinking ability?

Assumptions

The following theoretical assumptions were made based upon Cummins' (1976) threshold hypothesis:

1. Failure to resolve difficulties in coping with two languages over a prolonged period of time can negatively influence an individual's rate of cognitive development.
2. Once a certain level of competence in two languages has been attained, bilingual cognitive functioning can be positively influenced by aspects either of present access to two languages or bilingual learning experiences.

Definition of Terms

For purposes of the study the following definitions were used:

Critical thinking ability is the ability to engage in "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based . . ." (Facione, 1990, p. 3). The

literature revealed considerable discussion and lack of agreement on the precise conceptualization of critical thinking. After reviewing the work of most of the critical thinking theorists, the investigator decided to utilize this consensus definition from Facione's (1990) Delphi study. Critical thinking ability, as operationalized in the study, was the score achieved on the California Critical Thinking Skills Test.

Critical thinking disposition is the tendency toward being ". . . habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit . . ." (Facione, 1990, p. 3). Critical thinking disposition, as operationalized in the study, was the score achieved on the California Critical Thinking Disposition Inventory.

Additive bilingualism refers to high levels of competence in both languages, hypothesized to be associated with positive cognitive effects of bilingualism (Cummins, 1979a).

Dominant bilingualism is native-like level of competence in one of the languages, hypothesized to be associated with neither the positive or negative cognitive effects of bilingualism (Cummins, 1979a).

Semilingualism refers to less than native-like level of competence in both languages, hypothesized to be associated with the negative cognitive effects of bilingualism (Cummins, 1979a).

Bilingual proficiency as operationalized in the study, was composed of C-Test scores reflecting the degree of proficiency in each of the subjects' two languages (L_1 and L_2). L_1 represents the subjects' primary language C-Test score and L_2 represents the subjects' secondary language C-Test score. L_2 was used to reflect the subjects' degree of bilingual proficiency.

Summary

In summary, the investigator proposed to determine whether relationships exist among bilingualism, critical thinking ability, and the critical thinking disposition of baccalaureate nursing students. In leading to a better understanding of the relationships among these constructs, the findings primarily contribute in a theoretically significant way, by supporting the theories posited by Cummins (1976), and Whorf (1956). The findings also contribute in a theoretically significant way by refuting the theory posited by Vygotsky (1934/1962). In addition, the findings will likely contribute to future research efforts. The extent to which the study's findings contribute in significantly theoretical and practical ways is, of course, subject to the assumptions, definitions, and limitations herein specified.

CHAPTER 2 REVIEW OF THE LITERATURE

Introduction

A brief discussion of several theories and numerous research findings that are particularly relevant to the study will first be presented. Theories and corresponding empirical evidence of the interdependence of language systems in bilinguals will then be presented and identified as further support for the existence of a relationship between bilingualism and critical thinking ability. Relevant research findings focusing on the critical thinking ability and critical thinking dispositions of baccalaureate nursing students will then be presented. This will be followed by a presentation of both Whorf's (1956) and Vygotsky's (1934/1962, 1978) theories of the relationship between thought and language. Finally, Cummins' (1979a) threshold hypothesis will be presented in light of related theories as the theoretical basis for the study.

Cognitive Functioning in Bilinguals

The goal of this section is to report and relate to the study those research findings that both are relevant and provide support to the existence of positive relationships between bilingualism and critical thinking ability and between bilingualism and critical thinking disposition. As will become apparent, a waxing and waning pattern in the number of relevant research studies that have been conducted

during this century is clearly present. As a result of early studies yielding contradictory findings, the frequency of studies being conducted declined to an all time low around 1962 (Cummins, 1976; Reynolds, 1991). In 1962, however, Peal and Lambert (1962) published a landmark study that has been referred to as the *punctuation point* in bilingual research. The vastly improved methodological characteristics of the Peal and Lambert study combined with other factors will be identified as contributing to a resurgence of interest in studying the effects of bilingualism on cognitive development and functioning. The frequency of studies since Peal and Lambert's milestone study will be shown to have steadily increased, with more consistent findings further feeding a renewed interest in such research. Finally, a brief introduction to a constellation of factors that have been identified as confounds contributing to earlier contradictory findings will be followed by the means by which they will be controlled in the study.

Since the turn of the century, the cognitive effects of bilingualism have continuously been sought out. Most of the studies conducted during the first half of this century yielded contradictory findings as a result of what many have since viewed as significant methodological weaknesses. Generally, however, throughout these earlier studies, bilinguals were portrayed in comparisons with monolinguals as having lower IQ scores and generally poorer academic performance, and as being socially maladjusted (Reynolds, 1991). It now seems that nearly every early study that supported the notion that bilinguals suffered from some sort of *language handicap* has been countered by others that support the notion that bilinguals actually enjoy a

significant cognitive advantage over monolinguals. Specific methodological problems that such early studies apparently suffered from include lack of an agreed upon definition of bilingualism; difficulty in determining degree of bilingualism; failure to control for significant IQ correlates such as age, gender, socioeconomic background, and amount of education (especially in light of the significant selection threat to internal validity posed by nonrandomly assigned groups); the potential for experimenter expectancies biasing the results; incomparability of the bilingual and monolingual samples in terms of testing language proficiency (e.g., intelligence tests typically administered in the bilinguals' weaker language); use of tests that had not been standardized; and attempts to establish a causal relationship via cross-sectional research designs even though longitudinal experimental designs are more appropriate (Baker, 1988; Cummins, 1976; Diaz, 1983; Hakuta & Diaz, 1985; Hakuta, 1986; Kessler & Quinn, 1982; MacLaughlin, 1984/1985; MacNab, 1979; Macnamara 1966; Reynolds, 1991). As studies continued to yield contradictory findings due in part to their apparent methodological weaknesses, their frequency continued to decline until 1962.

In 1962, Peal and Lambert reversed the declining trend in the number of studies being conducted when they published what many have subsequently viewed as a study based upon a vastly improved methodological design. The Peal and Lambert (1962) study yielded results highly supportive of the positive cognitive effects of bilingualism. In their report, Peal and Lambert (1962) initially drew attention to the ratio of past studies that reported positive, negative, or no effects of bilingualism. According to

Peal and Lambert, the largest portion of the studies concluded that bilingualism has a detrimental effect on intellectual functioning, a smaller portion reported little or no effect, and only two studies concluded that bilingualism has a positive effect on intellectual functioning. In attempting to resolve what they believed to be contradictory findings produced by earlier studies, Peal and Lambert stressed the importance of controlling certain variables that would likely have presented confounds. Specifically, Peal and Lambert (1962) argued that ". . . important variables to control seem to be socioeconomic class, sex, degree of bilingualism, age, and the actual tests used" (p. 5). In light of the apparently poor research methodologies employed by earlier studies, Peal and Lambert concluded their review of the past research by arguing ". . . there is little evidence to suggest that bilinguals differ from monolinguals on nonverbal intelligence, but . . . at a certain stage in the learning of the second language, a bilingual may suffer from a *language handicap*" (p. 5). In examining the theoretical basis supporting the existence of such a relationship, Peal and Lambert called upon the work of others in the field and hypothesized that ". . . two groups of subjects, one monolingual and the other bilingual, should not differ significantly on nonverbal IQ, but might differ on verbal IQ as measured by intelligence tests standardized in the native language of both the monolinguals and bilinguals . . . [with] the monolinguals . . . expected to perform significantly better than the bilinguals on the verbal tests" (p. 7). The unexpected results of their study led them to conclude that "bilinguals performed better than monolinguals on verbal and nonverbal intelligence tests" (p. 20). In attempting to reconcile this finding with the intellectual

nature of the two groups, Peal and Lambert argued that bilinguals have ". . . a language asset, are more facile at concept formation, and have a greater *mental flexibility* . . . [and that factor analysis results suggest they] have a more diversified set of mental abilities than [do] the monolinguals" (p. 22). Peal and Lambert described their newly discovered mental flexibility in terms of a bilingual's habitual language switching as follows:

Compound bilinguals typically acquire experience in switching from one language to another, possibly trying to solve a problem while thinking in one language, and then, when blocked, switching to the other. This habit, if it were developed, could help them in their performance on tests requiring symbolic reorganization since they demand a readiness to drop one hypothesis or concept and try another. (p. 14)

Such a habit is believed by the present investigator to be an asset to anyone attempting to think critically. Overall, the Peal and Lambert study has been widely recognized as a milestone in bilingualism research.

In paying homage to the significant impact that the Peal and Lambert study had upon subsequent research on bilingualism, Hakuta, Ferdman, and Diaz (1986) referred to it as the "punctuation point" in bilingual research. Many who attempted to downplay Peal and Lambert's (1962) positive findings were thwarted by their incorporation into the study of numerous controls that previously remained, for the most part, overlooked. Reynolds (1991) has attributed the profound effect the Peal and Lambert study has had on the fields of psycholinguistics and bilingual education to three factors. First, its methodology was far superior to former studies. Second, the results of the study were very significant from a sociopolitical perspective in that the findings implied ". . . that a policy of national bilingualism would not be a policy

of national intellectual inferiority" (Reynolds, 1991, p. 147). Third, the study was published in the same year that the theory of Lev Vygotsky (1934/1962) was translated and published. Thus, the Peal and Lambert study contributed substantially to a renewed interest in studies of bilingualism. Following the lead of Peal and Lambert, later studies have been designed to be more methodologically sound and their respective findings have more consistently provided support of numerous positive cognitive effects resulting from bilingualism. Findings resulting from these more recent studies yield support to the notion of bilingualism being associated with enhancements in such cognitive functioning factors as divergent thinking skills (Carringer, 1974; Landry, 1974; Torrance, Gowan, Wu, & Aliotti, 1970), field independence (Duncan & DeAvila, 1979), concept formation (Bain, 1974; Liedtke & Nelson, 1968), linguistic and metalinguistic awareness (Cummins, 1978; Feldman & Shen, 1971; Ianco-Worrall, 1972), and cognitive flexibility in terms of both verbal and spatial ability tasks (Balkan, 1970; Ben-Zeev, 1977; Landry, 1974; Peal & Lambert, 1962). Such findings may be viewed as supportive of the existence of relationships between both bilingualism and critical thinking ability, and bilingualism and critical thinking disposition. The extent to which such findings support the existence of these two relationships is a function of the association between the theoretical constructs examined in each of the respective studies and both critical thinking ability and disposition.

Bilingualism and Critical Thinking Ability

In terms of the field independence/dependence dimension of cognitive style, Duncan and DeAvila (1979), while carefully controlling for the sample's actual degree of bilingualism, discovered that children whose bilingualism was categorized as *balanced*, exhibited advanced skills at perceptual disembedding and produced the most field-independent drawings when compared with the other groups studied. Duncan and DeAvila further uncovered a positive linear relationship between degree of relative language proficiency in English and Spanish and field independence.

Thus, in terms of the relationship between research findings that support a bilingual's more field independent cognitive style and the present study, Facione's (1990) conceptualization of critical thinking ability specifically identifies "... purposeful, self-regulatory judgment which results in . . . explanation of . . . *contextual considerations* upon which that judgment is based . . ." (p. 3) as a key component of the ability to think critically. Therefore, the Duncan and DeAvila (1979) study findings also support the existence of a relationship between bilingualism and critical thinking ability. Additional support for the existence of a relationship between bilingualism and critical thinking ability, as provided via the notion of field independence, is available in the form of a study conducted by Gunning (1981). In studying the relationships among field independence, critical thinking ability, and the clinical problem solving ability of baccalaureate nursing students, Gunning (1981) discovered, among other things, a statistically significant positive relationship between field independence and critical thinking ability.

Using a Piagetian theoretical framework in their study of concept formation, Liedtke and Nelson (1968) investigated differences between bilinguals and monolinguals on a concept formation task. On both measures utilized in their study, bilinguals performed significantly better than their monolingual counterparts. So great was the difference that Liedtke and Nelson were compelled to conclude that "a second language should be introduced during the early years when experience and environmental factors are most effective in contributing to the development of intelligence" (p. 231). Bain (1974) on the other hand, chose to examine the effects of bilingualism on discovery learning tasks. Such tasks have been characterized in Piagetian terms as involving concept formation abilities such as classification and generalization of rules. While very carefully controlling for bilingual/monolingual group differences, Bain (1974) discovered that, although not to a level of statistical significance, bilinguals did outperform their monolingual counterparts in measures of concept formation. In summary, such studies suggest that bilinguals have enhanced concept formation abilities over their monolingual counterparts.

Thus, in terms of the relationship between research findings that support a bilingual's enhanced concept formation ability and the present study, Facione's (1990) conceptualization of critical thinking ability specifically identifies ". . . purposeful, self-regulatory judgment which results in . . . *explanation of . . . conceptual . . . considerations* upon which that judgment is based . . ." (p. 3) as a key component of the ability to think critically. Therefore, the aforementioned findings also support the existence of a relationship between bilingualism and critical thinking ability.

As a result of one of the most detailed accounts of childhood language acquisition, Leopold (1949)--in closely studying the acquisition of two languages by his daughter Hildegard--postulated that the separation of word sound from word meaning leads to an early awareness in the bilingual child of the conventionality of words and the arbitrariness of language. Leopold further postulated that such an awareness could promote more abstract levels of thinking. Leopold's beliefs are in accord with what Vygotsky considered one of the advantages of bilingualism, that is, that it nurtures abstraction by freeing the mind "from the prison of concrete language forms and phenomenon" (Cummins, 1976, p. 29). Vygotsky (1934/1962) has argued further that being able to express the same thought in different languages enables one to "see his language as one particular system among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations" (p. 110). Such views of a bilingual's enhanced metalinguistic awareness find empirical support via numerous studies that have since been conducted. For example, Feldman and Shen (1971) in a study of 5-year-old bilinguals and monolinguals found bilinguals to be better at relabeling objects and expressing relationships between objects in simple sentences. Ianco-Worrall (1972) conducted what many researchers believe to be an especially well designed and controlled set of experiments examining the effects of bilingualism on linguistic awareness in 4- to 6-year-old children. The results of her study led Ianco-Worrall to conclude that bilingual children reach each stage of semantic development two to three years earlier than their monolingual counterparts. Cummins (1978) later followed suit by examining the effects of

bilingualism specifically on metalinguistic awareness, which he defined as the ability to objectively analyze linguistic output and to "look at language rather than through it to the intended meaning" (p. 127). In his study of third- and sixth- grade bilinguals in which he controlled for differences due to IQ and socioeconomic status, Cummins (1978) discovered that his bilingual subjects had a greater awareness of the arbitrary nature of linguistic reference. In a second experiment, Cummins (1978) discovered results that were "consistent with previous findings in that they suggest that bilingualism promotes an analytic orientation to linguistic input" (p. 135). Finally, as for the direct relationship between critical thinking ability as but one facet of thought and general verbal ability, studies suggest that a relationship truly exists (Facione, 1990; Rust, Jones, & Kaiser, 1962). Follman (1993) has gone so far as to argue that ". . . critical thinking probably does not exist as a psychometrically established, unique construct separate from verbal ability" (p. 74).

Thus, in terms of the relationship between research findings that support a bilingual's enhanced metalinguistic awareness and the present study, Facione's (1990) conceptualization of critical thinking ability specifically identifies ". . . purposeful, *self-regulatory judgment . . .*" (p. 3) as a key component of the ability to think critically. Therefore, the aforementioned findings also support the existence of a relationship between bilingualism and critical thinking ability.

Bilingualism and Critical Thinking Disposition

In comparing the creative functioning of bilingual and monolingual children in Singapore, Torrance, Gowan, Wu, and Aliotti (1970) expected a positive correlation to be uncovered. Creativity is closely identified by Torrance with divergent productions and transformations as with the ability to take different perspectives and different approaches to a given problem. Although the study is not without its own methodological weaknesses, it yielded findings indicative of bilingual/monolingual group differences in originality. Carringer (1974), in studying high school students of varying degrees of bilingual proficiency, also discovered significant differences in creativity test performance. Carringer concluded that "bilingualism does promote creative thinking abilities and at least in part serves to free the mind from the tyranny of words" (p. 502). Carringer further argued that "since the bilingual has two terms for one referent, his attention is focused on ideas and not words, on content rather than form, on meaning rather than symbol, and this is very important in the intellectual process as it permits greater cognitive flexibility" (p. 503). In a similar study Landry (1974) concluded that flexibility--produced by learning a second language--was conducive to both divergent thinking and originality. Landry based his conclusion on the fact that although no difference in creativity was discovered between first graders enrolled in a regular school program and those who were also learning a second language, by the third grade the two groups exhibited significant differences in favor of the second language learners on all measures of the Torrance test.

Thus, in terms of the relationship between research findings that support the enhanced divergent thinking skills of bilinguals and the present study, Facione's (1990) conceptualization of critical thinking disposition specifically identifies *inquisitiveness* and *willingness to reconsider alternatives* as key dispositions of an ideal critical thinker. Therefore, the research findings also support the existence of a relationship between bilingualism and critical thinking disposition.

Finally, in terms of cognitive flexibility--a term that has been variously defined--Peal and Lambert's (1962) study--as presented earlier--was perhaps the first to present empirical evidence of enhanced *mental flexibility* being associated with bilingualism. Balkan (1970), later used the cognitive flexibility term to describe performance on *perceptual* and *set changing* tasks as measured by several tests including *Figures Cachees* and *Histoires*. In this frequently cited study of a bilinguals' cognitive flexibility, Balkan discovered that not only did the bilingual group perform significantly higher than the monolingual group in both measures, but that the positive effects of bilingualism on cognitive flexibility were most pronounced in those subjects who had become bilingual prior to age four. In the Landry (1974) study, the cognitive flexibility term was used to described divergent thinking skills measured by tests of creativity. Although Landry's study yielded findings that provide support primarily to the notion of enhanced divergent thinking skills of bilinguals, the same findings, when expressed in different terms may be viewed as providing support secondarily to the concept of enhanced cognitive flexibility of bilinguals. Finally, Ben-Zeev (1977) has used the cognitive flexibility label to describe bilinguals' improved attention to

structure in detail. In her study of Hebrew-English bilingual children, Ben-Zeev found that bilingual children displayed superiority in both symbol substitution and verbal transformation tasks. In addition, Ben-Zeev reported that bilinguals are better than their monolingual counterparts in certain matrix transposition tasks. In summarizing her results, Ben-Zeev (1977) argued as follows:

Two strategies characterized the thinking patterns of the bilinguals in relation to verbal material: readiness to impute structure and readiness to reorganize. The patterns they seek are primarily linguistic, but this process also operates with visual patterns, as in their aptness at isolating the dimensions of a matrix. (p. 1017)

According to Ben-Zeev (1977), bilinguals must develop a keen awareness of the structural similarities and differences between their two languages in their attempts to avoid linguistic interference.

Thus, in terms of the relationship between research findings that support a bilingual's enhanced cognitive flexibility and the present study, Facione's (1990) conceptualization of critical thinking disposition specifically identifies *open-mindedness, flexibility, and willing to reconsider* as key dispositions of the ideal critical thinker. Therefore, the research findings also support the existence of a relationship between bilingualism and critical thinking disposition.

Thus, the relationship between bilingualism and enhanced cognitive functioning finds support in research findings. Such findings are also believed to provide strong evidence of the existence of positive relationships between bilingualism and enhanced critical thinking ability, and between bilingualism and enhanced critical thinking disposition.

In summary, the frequency of studies that have examined the cognitive functioning of bilinguals, although representing a waxing andwaning of interest as a result of early contradictory but primarily negative and later primarily positive findings, has, since 1962, continued to increase. The Peal and Lambert (1962) study has come to be recognized by many as significantly contributing to not only a better understanding of the effects of bilingualism on cognitive functioning but also to more methodologically sound research intended to uncover such effects. Following the vastly improved research methodology lead established by the Peal and Lambert (1962) study, numerous researchers have since consistently reported findings in support of many cognitive functioning benefits being associated with bilingualism. Finally, upon reviewing a sampling of such research studies, the present investigator offered empirical evidence in support of the existence of relationships between bilingualism and critical thinking ability and between bilingualism and critical thinking disposition.

Language Interdependence in Bilinguals

The goal of this section is to report and relate to the study those theories and research findings that both are relevant and provide further support to the existence of a relationship between bilingualism and critical thinking ability. In order to achieve this goal, the linguistic interdependence theories posited by Paivio (1991) and Cummins (1981) will first be presented. Empirical evidence in support of Cummins' (1981) theory will then be identified. Finally, the two theories will be posited as a

basis for the existence of a relationship between bilingualism and critical thinking ability.

Theories regarding the relationship between the two language systems of a bilingual have been posited both by Paivio (1991) and Cummins (1981). In building upon the work of their predecessors, Paivio and Desrochers (1980) developed the bilingual dual coding model in which Paivio (1991) postulates the existence of three systems. In addition to the two separate verbal systems corresponding to each of the bilingual's two languages, there exists a third, nonverbal imagery system that connects both verbal systems in a one-to-many fashion in both directions. According to Paivio, "the three systems are assumed to be functionally independent but also interconnected in ways that would produce effects consistent with functional interdependence under appropriate conditions" (Paivio, 1991, p. 118). Paivio originally formulated his theory in an attempt to better explain why the bilingual's languages sometime appear to be independent and, at others times, interdependent. According to Paivio (1991), "positive cross-language transfer and savings in learning tasks could be mediated by common images elicited by translation equivalents or by a direct translation tactic" (p. 122). Such a representation is highly congruent with others that have been proposed and supports the potential for transferability of knowledge across language systems. Figure 1 represents the relationship between the two language systems of a bilingual as postulated by Cummins (1981).

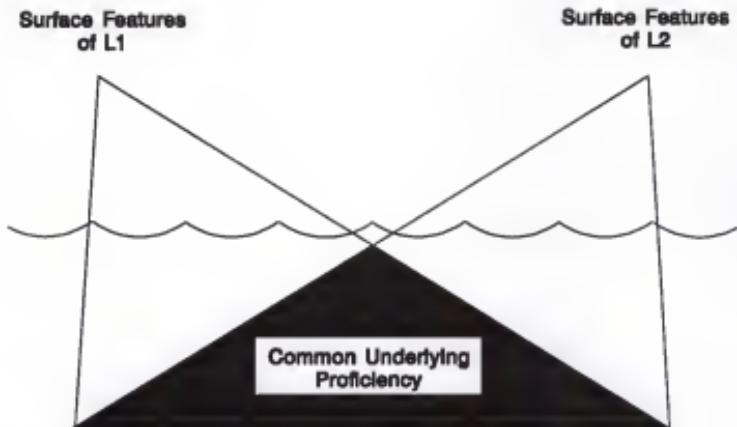


Figure 1 Cummins' (1981) linguistic interdependence model

Cummins (1985) argued that "first and second language academic skills are interdependent, i.e. manifestations of a common underlying proficiency" (p. 142). Cummins based his argument on the fact that "in bilingual programme evaluations little relationship has been found between amount of instructional time through the majority language and academic achievement in that language" (p. 142). Cummins (1985) has further argued in more concrete terms that what this principle means is that "in a Spanish-English Bilingual programme, Spanish instruction that develops first language reading skills for Spanish-speaking students is not just developing Spanish skills, it is also developing a deeper conceptual and linguistic proficiency that is

strongly related to the development of English literacy and general academic skills" (p. 134). In identifying some of the literacy-related skills involved in the common underlying proficiency, Cummins (1985) argued that "subject matter knowledge, higher-order thinking skills, reading strategies, writing composition skills, etc. developed through the medium of L₁ transfer or become available to L₂" (p. 144). Cummins (1985) bases his common underlying proficiency principle in evidence derived from the following:

- (1) results of bilingual education programmes . . . (2) studies relating both age on arrival and L₁ literacy development to immigrant students' L₂ acquisition . . . (3) studies relating bilingual language use in the home to academic achievement . . . (4) studies of relationships of L₁ to L₂ cognitive academic proficiency . . . and (5) experimental studies of bilingual information processing. (p. 144)

The relationship between the two languages in a bilingual, as postulated by the theories of both Paivio and Cummins, thus intimate the existence of a set of connections shared between the two language systems. This set of connections can be viewed as enhancing the potential for transferability of academic skills and knowledge between a bilingual's two language systems. The enhanced ability to transfer such skills and knowledge between language systems is believed to have a positive impact on a bilingual's ability to think critically, hence providing additional support to the existence of a relationship between bilingualism and critical thinking ability.

In summary, theories describing the relationship between a bilingual's two language systems as being interdependent were presented as enhancing a bilingual's enhanced cognitive function potential and in turn his or her ability to think critically. Evidence in support of Cummins' (1981) common underlying proficiency principle

was then identified. Finally, the two theories were posed as a basis for positing the existence of a relationship between bilingualism and critical thinking ability.

Critical Thinking Ability and Disposition in Nursing Students

The goal of this section is to present those theories and research findings that both are relevant and provide a basis for postulating the existence of a relationship between critical thinking disposition and critical thinking ability in baccalaureate nursing students. The reader will develop a better appreciation of the reasons contributing to the paucity of empirical research in this area. As will become apparent, such research has been severely constrained by a dearth of instruments designed to measure the disposition toward critical thinking. Based on Lewin's (1935) theory of motivation and the empirical research findings in nursing, a case will be presented that suggests the existence of a relationship between critical thinking disposition and critical thinking ability in baccalaureate nursing students.

Of the relationships the study was aimed at uncovering, the relationship between critical thinking disposition and critical thinking ability stands out as being the least established through empirical research findings. The relationship is believed to be complex in nature and has therefore not yet been fully elucidated (Facione, Facione & Sanchez, 1994a). According to Facione, Facione, and Sanchez (1994b), revealing a relationship between the disposition toward critical thinking and the ability to think critically poses a significant challenge since as they describe it:

As with so many person-characteristics, it may be the case that we will not find direct behavioral manifestations of a person's disposition toward

critical thinking. It might happen that CT abilities and the disposition toward CT are strongly correlated at the higher end of the spectrum, but not correlated significantly in persons with lower skill or dispositional levels. Or, perhaps more in keeping with what experienced educators might predict, the correlations are stronger at the two ends of the spectrum, but not in the middle ranges. (p. 13)

Additional challenges to the study of the relationship between critical thinking disposition and critical thinking ability have been posed via the greatly delayed formulation of a consensus conceptualization of critical thinking disposition.

Theoretical support for the existence of a relationship between critical thinking disposition and critical thinking ability exists in the form of Lewin's (1935) theory of motivation. Lewin's (1935) theory predicts the existence of such a relationship based on an individual's motivation to establish equilibrium between the disposition toward and the ability to think critically. Motivation stemming from a need to establish equilibrium through the attainment of critical thinking skills thus supports the notion that the relationship is most pronounced when the individual exhibits high levels both in their disposition toward and in their ability to think critically. Such a theory also implies that until a minimal threshold of critical thinking ability is attained the relationship may not be apparent (Facione, Facione & Sanchez, 1994a).

In terms of the disposition toward critical thinking in nursing, Facione, Facione, and Sanchez (1994b) have argued that "at an intuitive level the disposition toward CT seems evident in the exercise of clinical judgment . . ." (p. 15). Such an intuitive sense is based in part upon conceptual analyses of professional judgment that Facione, Facione, and Sanchez (1994b) further argue is composed of "(a) content knowledge . . . (b) experiential knowledge . . . and (c) the disposition and ability to use CT to make

sound, informed, reasoned, purposeful, and reflective professional judgments" (p. 15). Such a belief finds further empirical support based in research conducted in the field of nursing. In a study conducted by Berger (1984), baccalaureate nursing students were found to have higher critical thinking abilities than liberal arts students, thus lending support to the existence of a relationship between critical thinking disposition and ability via Facione, Facione, and Sanchez's (1994b) componential description of professional judgment. Further evidence of the link between critical thinking disposition and nursing, according to Sweeney (1993), has been documented for almost 100 years and it continues in the present time. According to Sweeney (1993), "critical thinking along with professional values and attitudes, [that may be viewed as critical thinking dispositions] and the ability to integrate theory into the role of the nurse are viewed as competencies essential to professional nurses" (p. 20). Finally, as previously cited, studies conducted by Gunning (1981) have established a link between field independence and critical thinking ability in baccalaureate nursing students that when combined with studies that have yielded support for a relationship between field independence and bilingualism together provide support to the existence of a relationship between bilingualism and critical thinking ability in baccalaureate nursing students.

In summary, although a much delayed consensus as to the precise conceptualization of critical thinking disposition and the corresponding dearth of available instruments to measure the construct have placed significant constraints on the exploration of relationships between critical thinking disposition and ability, the

relationship finds support in both theory and empirical research findings. In presenting such evidence, a case was built in support of the existence of a yet to be fully elucidated relationship between critical thinking disposition and critical thinking abilities in baccalaureate nursing students.

Thought and Language

This section will address two particular theories of the relationship between language and thought as posited first by Whorf (1956) and then by Vygotsky (1934/1962, 1978). Both theories further support the existence of relationships between both bilingualism and critical thinking ability and between bilingualism and critical thinking disposition.

Perhaps two of the most widely recognized theories of the relationship between language and thought have been posited by Whorf and Vygotsky. Both of their theories suggest that language plays a role in various thought processes. Of the two theories, Whorf's is the less definite. As a result of a lack of specificity in Whorf's theory, various interpretations of it have continued to spark controversy over the yet to be fully understood nature of the relationship between language and thought.

According to Whorf's (1956) *linguistic determinism* hypothesis, language may be viewed as determining the shape of thought. As Whorf (1956) wrote:

We dissect nature along lines laid down by our native languages . . . we cut nature up, organize it into concepts, and ascribe significance as we do, largely because we are parties to an agreement to organize it in this way - an agreement that holds throughout our speech community and is codified in the patterns of our language. The agreement is, of course, an

implicit and unstated one, BUT ITS TERMS ARE ABSOLUTELY OBLIGATORY. (p. 213)

In combination with Whorf's notion of *linguistic relativism*, which basically argues that languages differ in how they segment reality, Whorf's hypotheses postulate that speakers of different languages are forced into different patterns of thought as well. Although Whorf's lack of specificity in formalizing his theory has left many scholars desiring greater detail, evidence has tended to support what has been referred to as a *weak Whorfian position* (Hakuta, 1986). That is, instead of the relationship between language and thought being characterized as deterministic, it is best characterized by Whorf's hypothesis as a tendency. Hakuta (1986) has argued that the weak form of the Whorfian hypothesis may be viewed as suggesting that "the bilingual is a happy thinker. Any given problem can be handled through two linguistic systems, and the languages can be alternated in search of the one that . . . more efficiently guides thinking" (p. 77). Thus, although Whorf has failed to be specific in describing his theory of the relationship between language and thought, it clearly is difficult to refute the possibility that one's thought processes have a tendency to operate along different lines defined by one's language and as such would provide a bilingual a wider range of thought.

Vygotsky (1934/1962, 1978) has similarly theorized that language plays a crucial part in cognitive development. Vygotsky (1978) was particularly interested in the speech that children directed toward themselves when attempting to solve problems. Vygotsky (1978) distinguished this special form of speech--that he referred to as *egocentric speech*--from *social speech* that is used by children when

communicating ideas. For Vygotsky (1978) "the greatest change in children's capacity to use language as a problem-solving tool takes place . . . when socialized speech (which was previously used to address an adult) is turned inward" (p. 79). In addressing metalinguistic awareness in bilinguals, Vygotsky (1934/1962) argued that bilingualism allows the child "to see his language as one particular system among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations" (p. 110). Thus, Vygotsky has argued that language plays a crucial role in the development of logical thought in that it is initially used by the child as a form of communication but later also becomes a medium for organizing thought and ordering the components of its abstract symbol system.

In summary, the theories of Whorf and Vygotsky, convincingly support the relationship between thought and language. Both theories clearly suggest that language plays a mediating role in the cognitive functioning of bilinguals. Thus, the theories of both Whorf and Vygotsky can be viewed as providing support to the existence of relationships between both bilingualism and critical thinking ability and between bilingualism and critical thinking disposition.

Threshold Hypothesis

The goal of this section is to describe Cummins' (1976) threshold hypothesis as it relates to the present study. The threshold hypothesis will first be presented in light of related theories. Finally, the threshold hypothesis will be presented as the primary theoretical basis for the study.

The threshold hypothesis initially evolved, according to Cummins (1979a), "as an attempt to resolve the apparent inconsistencies in the results of early and more recent studies of the relationships between bilingualism and cognition" (p. 227). Such inconsistencies were due in part to the contexts in which the studies were carried out. Many of the studies yielding support for the idea of the positive cognitive effects of bilingualism were conducted in settings that fostered the development of an additive form of bilingualism. Conversely, studies that yielded evidence denying the existence of such positive cognitive effects were conducted in settings that fostered the development of a subtractive form of bilingualism. Based on such an observation, Cummins (1976) formulated the threshold hypothesis.

In describing the threshold hypothesis, Cummins (1976) initially postulated that ". . . the level of linguistic competence attained by a bilingual child may mediate the effects of his bilingual learning experiences on cognitive growth" (p. 1). In a later work, Cummins (1979a) restated the threshold hypothesis:

The attainment of a lower threshold level of bilingual competence would be sufficient to avoid any negative cognitive effects; but the attainment of a second, higher, level of competence might be necessary to lead to accelerated cognitive growth. (p. 230)

As is depicted in figure 2, the threshold hypothesis assumes that "those aspects of bilingualism which might positively influence cognitive growth are unlikely to come into effect until the child has attained a certain minimum or threshold level of competence in a second language" (Cummins, 1979a, p. 229).

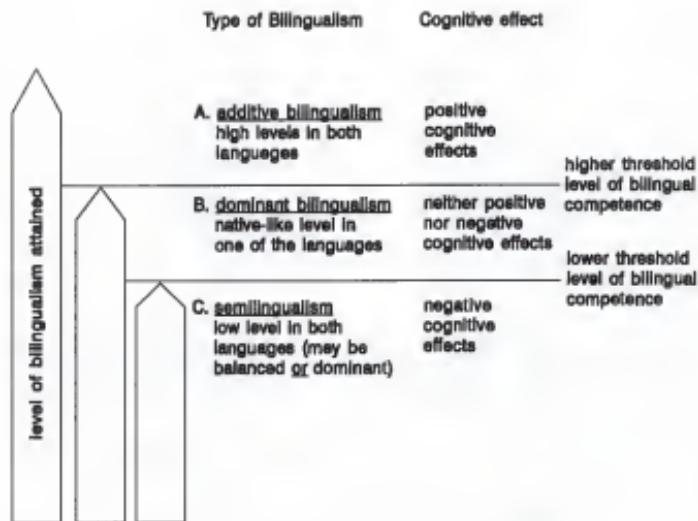


Figure 2 Cognitive effects of different types of bilingualism

In addition, attainment of only a very low level of competence in the second (or first) language, will result in an impoverishment in the interaction with the environment through that language (Cummins, 1979a).

Other researchers have since provided empirical evidence in support of the notion that the relationship between cognitive factors (e.g., critical thinking ability and critical thinking disposition) and bilingualism is very much determined by the extent of language competence in each of the two languages (Duncan & DeAvila, 1979; Hakuta & Diaz, 1985; Kessler & Quinn, 1980). According to Cummins (1979a), the threshold hypothesis may be viewed as ". . . a framework with which to predict the

academic and cognitive effects of different forms of bilingualism" (p. 232). It is precisely through this framework that the study was expected to uncover relationships among bilingualism, critical thinking ability, and the critical thinking disposition of baccalaureate nursing students.

Still, others have theorized about the role that language plays in thought. Bruner (1973, 1975) for example, has postulated how children use language to develop solutions to problems. Segalowitz (1977), in focusing more on bilinguals, has argued that bilinguals should have a superior *mental calculus* resulting from switching between their two rule systems. As interesting as these hypotheses may be, the theories of Vygotsky and Whorf, as previously discussed, provide the greatest support for the posited relationship between thought and language and in turn for the existence of relationships between both bilingualism and critical thinking ability and between bilingualism and critical thinking disposition.

Cummins' (1979a) threshold hypothesis was identified as the most appropriate theoretical framework with which to examine the relationships among bilingualism, critical thinking ability, and critical thinking disposition. The major focus of the present study was to test Cummins' (1979a) threshold hypothesis in a new situation.

Summary

In summary, a review of the literature has uncovered both significant theoretical understandings and empirical evidence in support of the concept of the existence of relationships among bilingualism, critical thinking ability, and the critical thinking

disposition of baccalaureate nursing students. Such evidence was organized and presented in terms of the cognitive functioning of bilinguals, language interdependence in bilinguals, critical thinking ability, and critical thinking disposition of baccalaureate nursing students, and the relationship between thought and language. Finally, Cummins' (1979a) threshold hypothesis was presented in light of related theories as the theoretical basis for the study.

CHAPTER 3 DESIGN AND METHODOLOGY

Introduction

This study was designed to determine if relationships exist among bilingualism, critical thinking ability, and critical thinking disposition of baccalaureate nursing students. This chapter includes a description of the research design, procedures, population and sample, instrumentation, data collection, and the data analysis to be used as a means of providing answers to the research questions aimed at addressing the research problem. The specific research questions posed consist of the following:

1. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability?
2. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition?
3. Is there a statistically significant relationship between critical thinking ability and critical thinking disposition?

Study Design and Procedures

As a result of the widely held belief supported by past research that random assignment to language development groups is practically impossible, the relationships among the constructs identified in the study were examined *within* groups. The study

design can therefore be summarized as a cross-sectional pooled within-bilingual correlational design in which a randomly selected group of baccalaureate nursing student volunteers was measured for language proficiency, critical thinking ability, critical thinking disposition, gender, age, grade point average, and socioeconomic status. Administration of the instruments at each of the four sites was performed within a single time block scheduled to maximize volunteerism and responsiveness while minimizing fatigue and boredom threats contributing to subject mortality.

Based upon a thorough review, several relevant factors were identified that should be controlled for when studying the relationship between bilingualism and critical thinking and between bilingualism and critical thinking disposition. Included among the factors for which the research suggests that controls be incorporated are age, gender, and socioeconomic status (Cummins, 1979a; Hakuta, Ferdman, & Diaz, 1986; Peal & Lambert, 1962). Reviews of past research also indicated the importance of examining the construct of bilingualism with great care. Hakuta, Ferdman, and Diaz (1986) argued that parcelling out first language ability from second language ability is the most appropriate means of measuring degree of bilingualism. In terms of potential confounds, which were particularly relevant to the study's population, other researchers have suggested that baccalaureate students are better critical thinkers than are associate nurses (Frederickson & Mayer, 1977; Gross, Takazawa, & Rose 1987; Kintgen-Andrews, 1988; Lynch, 1989). This potential confound to the present study was controlled by limiting the levels within the academic degree variable to one (i.e., the study examined only baccalaureate nursing students). Another pertinent factor,

shown by past research to have a particular bearing on studies involving nursing students, is the overall grade point average of the subject (Tiessen, 1987). Therefore, grade point average for each of the subjects involved in the study was determined and subsequently controlled for via statistical analysis. In terms of studies that have focused on an examination of the effectiveness of various critical thinking instructional programs, they have yielded mixed findings (Keller, 1993; Quellmalz, 1984; Smith, 1977; Sternberg & Bhana, 1986). Such studies have also left baccalaureate nursing program administration and faculty wishing for a clearer identification and understanding of the factors that most influence such instruction. Exposure of the subjects to critical thinking instruction was not considered therefore a confound to be controlled in the present study. Overall, the design of the present study incorporated statistical analysis as a means of controlling the potentially confounding influence of subject age, gender, socioeconomic status, and grade point average.

Population and Sample

The population from which subjects were drawn for the study consisted of students majoring in baccalaureate nursing programs at public universities in both Maine and New Brunswick, Canada. This population has a relatively high proportion of students being characterized by varying degrees of bilingual proficiency. Based upon communications with the universities' colleges of nursing, it was believed there would be a sufficient number of volunteers to support a minimal sample size of 100 subjects.

Instrumentation

Measures of the following variables were collected from each of the subjects participating in the study:

1. Bilingualism (C-Tests in both French and English);
2. Age (Demographic Data Questionnaire);
3. Gender (Demographic Data Questionnaire);
4. Socioeconomic status (Demographic Data Questionnaire);
5. Cumulative Grade Point Average (Demographic Data Questionnaire);
6. Critical thinking ability (California Critical Thinking Skills Test);
7. Critical thinking disposition (California Critical Thinking Disposition Inventory).

A description of each of these instruments follows.

C-Test

Language testers have long sought a relatively simple, easy, and inexpensive way of constructing reliable and valid language tests. C-Tests were originally developed during the early 1980s in response to a number of criticisms focused upon various cloze test deletion strategies in use at the time (Klein-Braley & Raatz, 1984). The word "cloze" was invented by W. L. Taylor to refer to a type of test originally designed to measure the readability of passages of prose (Taylor, 1953). Taylor (1953) derived the term from the gestalt psychology term for the tendency to complete a familiar but not-quite-finished pattern. Taylor's (1953) cloze test method later

became "widely adapted for testing language competence, both in first languages and second languages" (Carroll, 1987, p. 99). Instead of applying various methods of deleting whole words from a passage of prose to form a mutilated passage that the subject was then asked to reconstruct, the C-Test deletes the second half of every second word in a passage while leaving the first and last sentences intact. Although both tests present the subject with mutilated text that must be reconstructed, C-Tests have circumvented many of the problems associated with the cloze test. The aim of the developers of the C-Test was to "retain the underlying theory but to improve the sampling process in test development and therefore in subject performance" (Klein-Braley, 1985, p. 83). By improving the sampling process, the C-Test gets at a broader spectrum of general language proficiency sub-skills (e.g., vocabulary, grammar). The C-Test's ability to capture a broader spectrum of skills along different language proficiency dimensions is more in accord with Cummins' (1979b) basic interpersonal communication skills (BICS)/cognitive/academic language proficiency (CALP) theoretical framework that conceptualizes language proficiency in terms of cognitive demand and context embeddedness dimensions. Overall, the C-Test has proven to be easy to both construct and score, and has been accepted by examinees as a legitimate language testing procedure (Klein-Braley & Raatz, 1984). "The great virtue [sic] of the C-Test is that it spreads out examinees along a continuum and that the rankings it produces show high agreement with teacher judgments and with the results of other more complex language tests" (Klein-Braley & Raatz, 1984, p. 145).

It has been suggested that C-Tests be composed of four or more text passages in order to avoid text content bias. It has also been argued that C-Tests consisting of as few as two passages can provide reliable and valid information (Klein-Braley & Raatz, 1984). For the purposes of the present study, three passages were selected that were successfully utilized in a recent study conducted by Dornyei and Katona (1993). The Dornyei and Katona (1993) study involved subjects who exhibited language competence characteristics that are believed to be similar to those of the subjects in this study. Dornyei and Katona (1993) thoroughly analyzed the passages and discovered substantial evidence in support of the reliability and validity of the C-Test. The passages were selected in accord with the C-Test construction guidelines established by Klein-Braley and Raatz (1984). In terms of the appropriateness of the difficulty level of the C-Test passages utilized in this study, they were selected from the Dornyei and Katona (1993) study and are in accord with the guidelines. For example, in order to achieve an appropriate overall level of difficulty, Klein-Braley and Raatz (1984) recommend the first passage be very easy and that the difficulty should increase with each subsequent passage. It should be noted, however, that it has been repeatedly shown that "even tests which are far too difficult or far too easy for the target group will still produce acceptable reliability and validity coefficients" (Klein-Braley & Raatz, 1984, p. 140).

In discussing the characteristics of a good test, Harris (1969) argues "all good tests possess three qualities: validity, reliability, and practicality" (p. 13). While stressing the importance of test reliability and validity, Harris (1969) argues that a test,

which may be a highly reliable and valid instrument but is impractical to administer due to time, money, scoring, or interpretation limitations, may be virtually worthless. In terms of monetary practicality, it has been argued that the C-Test offers an economical way of measuring overall language proficiency (Hughes, 1989). Mortality of subjects due to fatigue and boredom are believed to possess a substantially greater cost to the validity of the present study than any increase in instrument validity attainable via selection of other less practical means (e.g., oral interview) of assessing general language proficiency. Thus, while the C-Test has garnered substantial evidence in support of its reliability and validity via numerous studies, its selection was partly based on issues of practicality.

Although previous researchers have consistently reported reliability coefficients of .80 or above, each C-Test must be tailored to the characteristics of the group being studied. As a result, reliability coefficients should be generated for each test either *ex post facto* or via a pilot study to ensure adequate instrument reliability. The internal consistency reliability coefficient for the C-Test used in the study was computed to be .75 (Dornyei & Katona, 1993). As a means of confirming adequate reliability for the C-Test used in this study, a reliability coefficient was computed for the French and English versions of the C-Test (.65 and .57 respectively) based upon the data collected and assessed per established guidelines found in the literature. Such guidelines call for the computation of a Cronbach alpha coefficient while treating each passage in the C-Test as a separate super-item. The treatment of each passage as a super-item is required due to the interdependence of C-Test items (Klein-Braley & Raatz, 1984).

Finally, it should be noted that, "in general even previously untried material has produced satisfactory reliability and validity coefficients" (Klein-Braley & Raatz, 1984, p. 144).

Validity coefficients computed for C-Tests have ranged from .5 to .7 in many of the studies reported in the literature. Dornyei and Katona (1993) utilized correlation and factor analyses on several criterion measures including a departmentally developed proficiency test, the Test of English for International Communication (TOEIC), and an oral interview. The results of the analyses showed the C-Test to have "highly sufficient positive correlations in all the composite language proficiency measures (General Language Proficiency, Department Proficiency Test Total and TOEIC Total), and [it] has significant positive correlations with all the language tests" (Dornyei & Katona, 1993, p. 191). Dornyei and Katona (1993) further concluded that the C-Test is "a highly integrative language test which measures global language proficiency" (p. 191). Interpretations of validity research, based in part on the observation that C-Test scores increase regularly and predictably with an individual's native language ability, further support the notion of the C-Test being a measure of overall language proficiency (Chapelle & Abraham, 1990). In perhaps the most comprehensive discussion of C-Test validity, Klein-Braley (1985) has presented C-Test validity evidence based both on theoretical and empirical grounds. According to Klein-Braley (1985), Chomsky's (1975) concepts of competence and performance represent the starting point for the theoretical basis of the C-Test's construct validity. "Competence is to be viewed as an abstract system of rules internalized in the

language used (the grammar); performance is the rule system in action, used for communication" (Klein-Braley, 1985, p. 78). Klein-Braley (1985) also establishes further empirical and theoretical underpinnings based on Oller's (1973) pragmatic expectancy grammar, the expected increase of C-Test scores with age, and the high intercorrelations among C-Tests. Lastly, the appropriateness of the C-Test in the context of the study finds further support in the notion that the C-Test measures language competence via sub-skills that are in agreement with Cummins' conceptualization of language proficiency. As such, the C-Test better probes a wider spectrum of sub-skills including the cognitive demand dimension of Cummins' conceptualization of language proficiency. Overall, "the C-Test has been shown to be both empirically and theoretically valid" (Klein-Braley & Raatz, 1984, p. 144).

Each of the subjects assessed in this study was required to complete both versions of the C-Test (Appendix 2). The C-Test was administered in the following sequence: administration of less dominant language C-Test passages followed by administration of the dominant language C-Test passages. Scoring the C-Test is a relatively easy process consisting of computing the sum of items correctly reconstructed by the subject for the passages that make up the C-Test. The determination of a subject's first (L_1) and second (L_2) languages was based upon the scores obtained by each subject in both versions of the C-Test. A subject's L_1 was considered that language corresponding to the version of the C-Test for which they received a higher score. Consequently, a subjects' L_2 was considered that language corresponding to the version of the C-Test for which they received the lower score. In

the event the subject obtained the same score on both versions of the C-Test, L₁ will default to English and L₂ will default to French in accord with the majority language of the population from which the samples were drawn.

Demographic Data Questionnaire

Each of the subjects assessed in this study was required to complete the Demographic Data Questionnaire (Appendix 1). Subjects were given sufficient time to complete the instrument. Responses to questions on this instrument provided basic subject identification data consisting of a randomly assigned student identification number reported by the subjects on all instruments during the data collection activities. In addition to age and grade point average data, the responses to questions regarding subject and family education, employment, and income level enabled determination of the subjects' relative socioeconomic status. Evidence for content validity was obtained through a review of the literature. The review yielded an identification of variables found to be significantly correlated with the dependent constructs that, if left unmeasured and uncontrolled, would likely confound the relationships being studied. These variables include grade point average (GPA), age, socioeconomic status, and first language proficiency. The socioeconomic status of each subject was computed by assigning the following weights to each item response (i.e., a = 0, b = 1, c = 2, d = 3), and summing together the responses to the socioeconomic status items (i.e., items 4 through 11) to form an overall socioeconomic status score ranging from zero--indicating a low socioeconomic status, to 24--indicating a high socioeconomic status.

California Critical Thinking Skills Test

For years the critical thinking construct has been variously defined and generally measured in the research via the use of the Watson-Glaser Critical Thinking Appraisal. In 1990, however, the results of what may be considered a milestone study aimed at formulating a consensus definition for the construct were published in what has come to be referred to as "The APA [American Philosophical Association] Delphi Report" (Facione, 1990). "The APA Delphi consensus conceptualization of critical thinking is an historically important benchmark" (Facione & Facione, 1994, p. 16). Perhaps the most significant result of the study was the derivation of a single consensus definition of critical thinking by experts in the field. The consensus definition has resulted in the development of an instrument that measures this most widely accepted conceptualization of critical thinking. It is important to note that the expression of the critical thinking definition was made without the constraints of accreditation or legislation, and was based on the participation of 46 leading theorists, teachers, and critical thinking assessment specialists from several disciplines (Facione, 1990). As no small task, Facione (1990) managed to make a significant contribution to the conceptualization and subsequently to the measurement of critical thinking. The California Critical Thinking Skills Test, published by the California Academic Press in concert with Facione, provides a composite score made up of sub-scores in each of the following five cognitive skills: analysis, inference, evaluation, inductive reasoning, and deductive reasoning. Items contained in the test are drawn from a pool of 200 items that were developed in a 20 year research program aimed at validly and reliably

testing critical thinking. Items selected for inclusion in the test cover the domain of the five cognitive skills that have been identified via the consensus definition of critical thinking. Pool items are discipline neutral in order not to prefer persons with specialized knowledge. Sex-role and social class stereotype contexts have been avoided; and equal numbers of male and female referents are used to further decrease gender and cultural test bias. The format of the test consists of 34 multiple-choice questions (Facione & Facione, 1994).

Internal consistency reliability (i.e., KR-20) of Form A of the test is .70 and that of Form B is .71. Although it is possible to increase reliability by increasing the test length, the publishers chose not to do so since it would take longer than a class period to complete and increasing the length may actually decrease reliability as the test is mentally demanding and error due to fatigue would be increased.

Construct validity evidence exists in numerous forms. Evidence of the face validity of the instrument has been attained from anecdotal information from college students exiting administrations of the test, and by faculty committees who have recommended adoption of the test for use in their institutions, various curricular research projects, and dissertation studies. Although assessment methodology remains a topic of mild controversy, most critical thinking experts agree that critical thinking skills can be validly and reliably assessed via multiple choice items. Thus the instrument provides for a sensible measure of the construct. In addition, construct validity is further supported via quasi-experimental studies that have been conducted to provide quantitative evidence of the tests ability to assess the appropriate targeted

phenomenon. These studies have shown significant pretest posttest gains for experimental but not control groups in studies that examined the effects of critical thinking instruction and that involved 1169 college students, five courses, 20 instructors, and 4 sections (Facione & Facione, 1994). Construct validation is of course a never ending process and efforts to provide further evidence are ongoing. Overall, construct validity for the test is greater than that of any other available for the construct of critical thinking as defined in the study. This is due to the fact that the test is the first and only instrument to derive its "construct validity from the APA Delphi Report conceptualization" (Facione & Facione, 1994, p. 16). In terms of concurrent validity, studies correlating the test "with other commercially available critical thinking tests and with observed classroom performance are in progress" (p. 18). However, in addition to a 1989/90 validation study of the test, "an independent 1992 research project found the test correlates with college level GPA, and with Scholastic Aptitude Test (SAT) verbal and SAT math scores" (p. 18). According to Facione, and Facione (1994), "Theoretically one would expect that students who experience a higher level of college success . . . will enjoy some of that success . . . in virtue of their ability at critical thinking" (p. 18).

Each of the subjects assessed in this study was required to complete the California Critical Thinking Skills Test. The test was administered and scored in strict agreement with the procedures published in the test manual.

California Critical Thinking Disposition Inventory

Facione's (1990) publication of the APA Delphi Report made possible the development of an instrument to measure critical thinking dispositions. Entitled the California Critical Thinking Disposition Inventory, the instrument provides a composite score made up of sub-scores for each of the following seven dispositions: truth-seeking, inquisitiveness, open-mindedness, confidence, analyticity, systematicity, and maturity. Items selected for inclusion in the test cover the domain of the seven dispositions that were reduced from the nineteen descriptive phrases of an ideal critical thinker identified in the consensus definition of critical thinking. The seven scales of the inventory are composed of nine to twelve items interspersed throughout the instrument. To decrease the likelihood of subjects giving socially desirable responses, the items are interspersed and the names of the seven scales are not revealed in the instrument, nor is the name of the instrument itself or its connection to critical thinking. The format of the test consists of 75 six-point Likert scale (i.e., agree-disagree) response items (Facione, Facione & Sanchez, 1994a).

Internal consistency reliability (i.e., Cronbach's alpha) of the inventory based upon a pilot test and several other administrations of the published version of the inventory consistently yielded a reliability index of .90 or above on the overall composite score (Facione, Facione & Sanchez, 1994a).

As the inventory is the first of its kind to be based on the 1990 consensus conceptualization of critical thinking dispositions, evidence of its validity continues to be gathered. However, similar to what has been argued in support of the validity of

the California Critical Thinking Skills Test, the inventory is the first and only instrument to derive its construct validity from the APA Delphi Report conceptualization (Facione, Facione & Sanchez, 1994a). Numerous college instructors have indicated their agreement with the appropriateness of the prompts, thus providing some measure of face validity. Both convergent and divergent validity research is currently ongoing with emphasis on "exploring the possible correlations of the CCTDI scores or its scale scores with other psychometric instruments of known reliability and validity in measuring similar constructs" (Facione, Facione & Sanchez, 1994a, p. 7).

Each of the subjects assessed in this study were required to complete the California Critical Thinking Disposition Inventory. Subjects were permitted to select either the English or French equivalent version of the test. The test was administered and scored in strict agreement with the procedures published in the test manual.

Data Collection

The convenience sample was drawn from four different sites and measured through the administration of the following instruments in the order presented: demographic characteristics via the Demographic Data Questionnaire, critical thinking disposition via the California Critical Thinking Disposition Inventory, language proficiency in each of English and French via the administration of the minor language version followed by the dominant language version of the C-Test, and critical thinking ability via the California Critical Thinking Skills Test. Each of the instruments were administered in strict agreement with published test manual guidelines. Data

collection sessions were scheduled to be completed within a single time block established to maximize volunteerism and responsiveness while minimizing fatigue and boredom threats contributing to subject mortality.

Data Analysis

For purposes of statistical inference regarding the existence of relationships among bilingualism, critical thinking ability, and critical thinking disposition, the following research hypotheses were addressed:

1. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability?
2. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition?
3. Is there a statistically significant relationship between critical thinking ability and critical thinking disposition?

Each of the research questions was addressed via the test of null hypotheses each of which postulates the absence of a significant relationship between the two variables in question. As a means of measuring the degree of bilingualism each subject attained, the method recommended by Hakuta and Diaz (1985) was utilized. According to Hakuta and Diaz (1985), "variation in L₂ controlling for variation in L₁ is attributable to the degree of bilingualism, and this variation should be related in a positive way to cognitive ability" (p. 331). Hakuta and Diaz (1985) further argue for the appropriateness of the multiple regression analysis approach in studies examining

the relationship between bilingualism and various cognitive functions. Thus multiple regression analysis was used to test each of the hypotheses. Computation of appropriate squared semi-partial correlations (R^2_{inc}) was also performed to aid in determination of the practical significance of the findings. In this way, statistically significant semi-partial correlations between the dependent measure and the corresponding independent measures being examined by each of the research questions may be viewed as sufficient evidence supporting a claim for the existence of a relationship between the two constructs in question. Thus for research question one (i.e., test for relationship between bilingualism and critical thinking ability) the following multiple regression model was utilized to test the statistical significance of the relationship.

$$\text{C.T. Ability} = L_1 + \text{GPA} + \text{Age} + \text{SES} + \text{Gender} + \text{C.T. Disp.} + L_2 + (L_2)^2$$

Similarly, research question two (i.e., test for relationship between bilingualism and critical thinking disposition) was addressed via testing the statistical significance of the semi-partial correlation between bilingualism and critical thinking disposition as expressed in the following multiple regression model.

$$\text{C.T. Disp.} = L_1 + \text{GPA} + \text{Age} + \text{SES} + \text{Gender} + L_2 + (L_2)^2$$

Finally, research question three (i.e., test for relationship between critical thinking disposition and critical thinking ability) will be addressed via testing the statistical significance of the semi-partial correlation between critical thinking ability and critical thinking disposition as expressed in the following multiple regression model.

$$\text{C.T. Abil.} = L_1 + \text{GPA} + \text{Age} + \text{SES} + \text{Gender} + L_2 + (L_2)^2 + \text{C.T. Disp.}$$

Summary

In summary, the study can best be characterized as a cross-sectional pooled within-bilingual correlational design. Data was collected from a convenience sample of baccalaureate nursing students enrolled in major public universities' colleges of nursing that were expected to have a relatively high proportion of students being characterized by varying degrees of bilingual proficiency. Instruments utilized to collect the required data included English and French versions of the C-Test, California Critical Thinking Skills Test, California Critical Thinking Disposition Inventory, and a investigator designed demographic data questionnaire. Analysis of the data was conducted using standard multiple regression techniques to determine the statistical significance of the relationships among bilingualism, critical thinking ability, and critical thinking disposition of the population being studied.

CHAPTER 4 FINDINGS

Introduction

This study was designed to determine if relationships exist among bilingualism, critical thinking ability, and the critical thinking disposition of baccalaureate nursing students. The purpose of this chapter is to report the findings of the study. This chapter also contains a description of the setting and subjects, the demographic characteristics of the subjects, descriptive statistics on subject performance on each of the instruments utilized in the study, and inferential statistics utilized in answering each of the research questions aimed at addressing the problem. The research questions posed consist of the following:

1. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability?
2. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition?
3. Is there a statistically significant relationship between critical thinking ability and critical thinking disposition?

Setting and Subjects

Data were collected during the spring semester, 1996, from four baccalaureate schools of nursing in New Brunswick, Canada and Maine, United States of America. These schools serve student populations determined through earlier communications to be characterized by varying degrees of bilingual proficiency. The study included 111 subjects as an uncompensated volunteer convenience sample. Table 1 indicates the frequency distribution of the sample by school. Although between-group analysis was not originally planned, dummy coding of the subjects' school was employed in the multiple regression analysis as a means of controlling potentially confounding group differences particularly in light of the nonrandom selection of participating schools.

Table 1

Frequency Distribution of Sample by School

School	Frequency	Percentage
1	7	6.3
2	48	43.2
3	18	16.2
4	38	34.3

n = 111

Demographic Characteristics of Sample

All students who volunteered to participate in the study were enrolled in a baccalaureate nursing program at one of the participating schools. Demographic data were collected with the investigator-designed demographic data instrument. These

data include the subjects' gender, age, cumulative grade point average, and socio-economic factors that subsequently were used to determine socio-economic status.

Gender and Age

Female students comprised the greatest percentage of the sample (82.9%; n = 92), while male students comprised only 17.1% (n = 19). Subject age ranged from 17 years to 50 years, with the mean age being 23.80 years and the standard deviation being 6.82.

Cumulative Grade Point Average and Socio-economic status

Subjects' cumulative grade point average (CGPA) ranged from 1.3 to 4.0 on a 4.0 scale with the mean CGPA being 2.98 and the standard deviation being .57. Subjects' socio-economic status (SES) ranged from 3.0 to 20.0 on a 24.0 scale with the mean SES being 9.37 and the standard deviation being 3.01.

Table 2 indicates the frequency distribution of the subjects by gender.

Table 2

Frequency Distribution of Sample by Gender

Gender	Frequency	Percentage
Female	92	82.9
Male	19	17.1

n = 111

Table 3 summarizes the remaining demographic characteristics of the study sample.

Table 3

Demographic Characteristics of Sample

Characteristic	n	Maximum Possible	Range	Mean	SD
Age	111	-	17-50	23.80	6.82
Cumulative Grade Point Average (CGPA)	111	4.0	1.3-4.0	2.98	.57
Socio-economic status (SES)	111	24.0	3.0-20.0	9.37	3.01

Subject Performance on Research Instruments

All students who volunteered to participate in the study were asked to complete four test instruments in addition to the investigator-designed demographic data instrument. Data were collected with two investigator-designed language proficiency instruments (French language C-Test, English language C-Test), the California Critical Thinking Skills Test, and the California Critical Thinking Disposition Inventory.

French Language C-Test

The investigator designed French Language C-Test was used to measure French language proficiency. Scores ranged from 0 to 66 on a 67 point scale with the mean French language C-Test score being 39.04 and the standard deviation being 23.17.

English Language C-Test

The investigator designed English Language C-Test was used to measure English language proficiency. Scores ranged from 15 to 61 on a 63 point scale with the mean English language C-Test score being 48.90 and the standard deviation being 8.59.

California Critical Thinking Skills Test

The California Critical Thinking Skills Test (CCTST) was used to measure critical thinking ability. Scores ranged from 2 to 23 on a 34 point scale with the mean CCTST score being 12.44 and the standard deviation being 4.37.

California Critical Thinking Disposition Inventory

The California Critical Thinking Disposition Inventory (CCTDI) was used to measure critical thinking disposition. Scores ranged from 241 to 364 on a 420 point scale with the mean CCTDI score being 309.86 and the standard deviation being 25.05.

Subject performance on each of the test instruments is summarized in Table 4.

Analysis of Data

All data were analyzed using the Statistical Analysis System release 6.07 (SAS, 1989). The mainframe computer facilities at the University of Maine were used for numerical processing. Simple descriptive statistics were computed to describe the

characteristics of the sample and performance on test instruments. Multiple regression analysis was used to test for statistically significant relationships among the constructs in question while controlling for the influence of all other study variables.

Table 4

Subject Performance on Test Instruments

Instrument	n	Maximum Possible	Range	Mean	SD
C-Test English	111	63	15-61	48.90	8.59
C-Test French	111	67	0-66	39.04	23.17
Critical Thinking Ability	111	34	2-23	12.44	4.37
Critical Thinking Disposition	111	420	241-364	309.86	25.05

As a result of the preliminary analysis of the data, three cases' data were identified as outliers and subsequently excluded from the inferential analysis portion of the study. Multiple regression analysis was performed on a sample of $n = 108$.

Prior to conducting the inferential analysis related to research hypotheses, additional consideration of potential confounds to the analysis was conducted. Since the subjects represented a convenience sample drawn from four different schools, a decision was made to supplement the multiple regression analysis model through the addition of three dummy coding (indicator) variables. Following the recommended practices presented by Cohen and Cohen (1983), dummy coding variables were added to account for potentially significant school-oriented subject differences that could confound the analysis of the relationships in question. Only three variables were used since only three are required for exhaustive classification of the four schools. Through

addition of the dummy coding variables to the model, subject differences that may have existed between schools could be controlled and eliminated as potential confounds to the analysis of the key relationships examined. Subsequent review of the analysis findings revealed sufficient evidence to support the notion of the existence of significant overall group mean differences for scores on the California Critical Thinking Skills Test ($F(3,96) = 6.6515$) whereas there did not exist sufficient evidence to support the postulated existence of significant overall group mean differences for scores on the California Critical Thinking Dispositions Inventory ($F(3,96) = 0.567$).

Tests of Hypotheses

The findings related to each of the three research questions are presented. An alpha level was established at $\alpha = .05$ and utilized in all inferential analyses except where otherwise indicated. Multiple regression analysis was conducted and based on recommended practices presented by both Hakuta and Diaz (1985), and Cohen and Cohen (1983). Hakuta and Diaz's (1985) statistical analysis recommendations are quite conservative in that for each of the relationships being examined they are tested apart from confounding influence of all other potentially significant effects.

Research Question #1

Research question one asked: Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability? For the purpose of answering this question through statistical inference the following null hypothesis was

established. Baccalaureate nursing students' scores on their weaker language (L_2) C-Test are not related to their scores on the California Critical Thinking Skills Test (CCTST).

$$H_{01}: \quad P_{y(x_1, x_2, \dots, x_n)}^2 = 0$$

where: y = CCTST score (critical thinking ability)
 x_1 = squared second language (L_2) score
 (bilingual proficiency)
 $x_2 \dots x_8$ = all other factors in model

$$H_{AI}: \quad P^2_{y(x_1, x_2, \dots, x_p)} > 0$$

This null hypothesis was tested via application of the multiple regression analysis technique. All assumptions corresponding to this parametric technique were tested to confirm they were being met. Subject scores on the California Critical Thinking Skills Test were identified in the multiple regression model as the dependent variable. Independent factors entered into the model included the subjects' gender, age, cumulative grade point average, socio-economic status, first language (L_1) score, score on the California Critical Thinking Disposition Inventory, second language (L_2) score, and the square of the second language (L_2) score. In addition, the three dummy coding variables were added to the model as independent variables. The square of the second (L_2) language score was added to the model in order to directly test whether the relationship was polynomial as predicted by Cummins' (1979a) threshold hypothesis. Given the directional nature of the alternative hypothesis an alpha level was established at $\alpha = .10$ and utilized in the inferential analyses that included

confirmation of the existence of matching signs for the resulting and hypothesized coefficient values. The squared semi-partial correlation between the subjects' score on the California Critical Thinking Skills Test and the subjects' squared second language (L_2) score ($r^2_{y(x1, x2, \dots, xk)} = .0097$) was found not to be significantly different from zero ($t = 1.211$, $p < 0.2287$) and the null hypothesis was not rejected. Based upon there not existing sufficient evidence to reject the null hypothesis, a statistically significant curvilinear relationship is not believed to exist between the bilingualism and the critical thinking ability of baccalaureate nursing students in this study.

Research Question #2

Research question two asked: Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition? For the purpose of answering this question through statistical inference, the following null hypothesis was established. Baccalaureate nursing students' scores on their weaker language (L_2) C-Test are not related to their scores on the California Critical Thinking Disposition Inventory (CCTDI).

$$H_{02}: P_{y(x_1, x_2, \dots, x_p)}^2 = 0$$

$$H_{AZ^2} = P_{Y(x_1 \cdot x_2 = x_3)}^2 > 0$$

This null hypothesis was tested via application of the multiple regression analysis technique. All assumptions corresponding to this parametric technique were tested to confirm that they were being met. Subject scores on the California Critical Thinking Disposition Inventory were identified in the multiple regression model as the dependent variable. Independent factors entered into the model included the subjects' gender, age, cumulative grade point average, socio-economic status, first language (L_1) score, second language (L_2) score, and the square of the second language (L_2) score. In addition, the three dummy coding variables were added to the model as independent variables. The square of the second (L_2) language score was added to the model in order to directly test whether the relationship was polynomial as predicted by Cummins' (1979a) threshold hypothesis. Given the directional nature of the alternative hypothesis, an alpha level was established at $\alpha = .10$ and utilized in the inferential analyses that included confirmation of the existence of matching signs for the resulting and hypothesized coefficient values. The squared semi-partial correlation between the subjects' scores on the California Critical Thinking Disposition Inventory and the subjects' squared second language (L_2) scores ($r^2_{y(x_1, x_2, \dots, x_7)} = .0279$) was found to be significantly different from zero ($t = 1.997$, $p < 0.0486$) and the null hypothesis was rejected. Based upon there being sufficient evidence to reject the null hypothesis a statistically significant curvilinear relationship is believed to exist between the bilingualism and the critical thinking disposition of the baccalaureate nursing students in this study.

Research Question #3

Research question three asked: Is there a statistically significant relationship between critical thinking ability and critical thinking disposition? For the purpose of answering this question through statistical inference the following null hypothesis was established. Baccalaureate nursing students' scores on the California Critical Thinking Skills Test (CCTST) are not related to their scores on the California Critical Thinking Disposition Inventory (CCTDI).

$$H_{03}: P^2_{y(x_1, x_2 \dots x_8)} = 0$$

where: y = CCTST score (critical thinking ability)
 x_1 = CCTDI score (critical thinking disposition)
 $x_2 \dots x_8$ = all other factors in model

$$H_{A3}: P^2_{y(x_1, x_2 \dots x_8)} \neq 0$$

This null hypothesis was tested via application of the multiple regression analysis technique. All assumptions corresponding to this parametric technique were tested to confirm that they were being met. Subject scores on the California Critical Thinking Skills Test were identified in the multiple regression model as the dependent variable. Independent factors that entered into the model included the subjects' gender, age, cumulative grade point average, socio-economic status, first language (L_1) score, score on the California Critical Thinking Disposition Inventory, second language (L_2) score, and the square of the second language (L_2) score. In addition, the three dummy coding variables were added to the model as independent variables. The square of the second (L_2) language score was added to the model in order to account for the

polynomial relationships between both bilingualism and critical thinking ability, and between bilingualism and critical thinking disposition as predicted by Cummins' (1979a) threshold hypothesis. The squared semi-partial correlation between the subjects' score on the California Critical Thinking Skills Test and the subjects' score on the California Critical Thinking Disposition Inventory ($r^2_{y(x_1, x_2, \dots, x_8)} = .0046$) was found to be not significantly different from zero ($t = 0.837$, $p < .4047$) and the null hypothesis was not rejected. Based upon there not existing sufficient evidence to reject the null hypothesis a statistically significant relationship is not believed to exist between the critical thinking ability and the critical thinking disposition of baccalaureate nursing students in this study.

Table 5 summarizes the results of the statistical tests of hypotheses.

Table 5

Statistical Tests of Hypotheses

Hypothesis	n	t	p	$r^2_{y(x_1, x_2, \dots, x_8)}$	Decision
H_{01}	108	1.211	.2287	.0097	Not rejected
H_{02}	108	1.997	.0486	.0279	Rejected
H_{03}	108	0.837	.4047	.0046	Not rejected

Supplemental Analyses

Inferential analysis conducted to address the research questions also produced results that provided sufficient evidence to support the existence of a positive relationship between subject age and score on the California Critical Thinking Disposition Inventory ($t = 2.610$, $p < 0.0105$). Similarly, the results also provided sufficient evidence to support the existence of a positive relationship between subject cumulative grade point average and score on the California Critical Thinking Disposition Inventory ($t = 2.141$, $p < 0.0348$). Finally, the results provided sufficient evidence to support the existence of a positive relationship between subject primary language (L_1) score and both their score on the California Critical Thinking Disposition Inventory ($t = 2.955$, $p < 0.0039$) and their score on the California Critical Thinking Skills Test ($t = 2.082$, $p < 0.0400$). Although these findings were not of primary interest, they were considered relevant given the nature of the study.

Summary

In summary, descriptive analysis of the data revealed a sample of students with a wide range of demographic characteristics. Inferential analysis was conducted through the use of the multiple regression technique based on recommended practices presented by Hakuta and Diaz (1985), and Cohen and Cohen (1983). The results of the statistical analysis for this sample revealed sufficient evidence supporting a statistically significant relationship between bilingualism and critical thinking disposition in baccalaureate nursing students, but not sufficient evidence to support a statistically significant relationship between either bilingualism and critical thinking ability or between critical thinking disposition and critical thinking ability of baccalaureate nursing students.

CHAPTER 5 SUMMARY AND DISCUSSION

Overview

This chapter summarizes the purpose of the study including a description of the research problem and method, the sample and method of analysis, and the results as they relate to each research question and corresponding null hypotheses. Each research question is addressed in turn with a summary of the findings being presented. The findings are discussed as they relate to the theories of Cummins (1979a), Whorf (1956) and Vygotsky (1934/1962) as well as to past research. Finally limitations and implications for educational practice are presented as well as recommendations for further research.

Summary of Research Problem and Method

This study addressed was designed to determine the existence of relationships among bilingualism, critical thinking ability, and the critical thinking disposition of baccalaureate nursing students. The research questions posed consist of the following:

1. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability?
2. Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition?

3. Is there a statistically significant relationship between critical thinking ability and critical thinking disposition?

The research design employed to address these questions was a cross-sectional pooled within bilingual correlational design. This design was employed specifically as a means of addressing the increasingly widely recognized methodological weaknesses of many of the past studies examining the cognitive effects of bilingualism (Cummins, 1979b; Diaz, 1985; Hakuta, 1986; Hakuta & Diaz, 1985; MacNab, 1979; Reynolds 1991). These studies have typically compared monolingual with bilingual group performance on various cognitive measures. As subjects involved in such studies were not randomly assigned to monolingual and bilingual upbringings and subsequently not randomly assigned to control (monolingual) and treatment (bilingual) groups, a substantial confounding influence was left uncontrolled, thereby introducing a significant threat to their internal validity. Many of the same studies have also been criticized for failing to control the confounding influences of other factors (e.g., socio-economic status) that have been shown to significantly differentiate the two groups and, when left uncontrolled, further reduce their internal validity. In addition, such studies have typically focused exclusively on *balanced* bilingual populations that are characterized as exhibiting balanced proficiency in each language and as a result have yielded findings that are far less generalizable. Finally, many of the studies have been criticized for inferring bilingualism as a causal factor. Specifically, such studies tend to view bilingualism as playing the causal role in the relationship between bilingualism and various cognitive factors. Lacking appropriate controls and having failed to

employ a longitudinal design renders many of the causal inferences unsubstantiated. To address such methodological weaknesses the study employed a pooled within bilingual correlational design with inferential statistics generated through the use of multiple regression analysis in accord with the recommended practices presented by Hakuta and Diaz (1985), and Cohen and Cohen (1983).

In the spring of 1996, a convenience sample consisting of 111 baccalaureate nursing students enrolled in four baccalaureate nursing degree programs being offered in New Brunswick, Canada and the state of Maine, U.S.A. participated as uncompensated volunteers in the study. The subjects were asked to complete the following five research instruments: a demographic data instrument, a French language C-Test, an English language C-Test, the California Critical Thinking Disposition Inventory, and the California Critical Thinking Skills Test. Descriptive statistics were generated from the data collected and used to describe the sample. Multiple regression analysis was employed to generate inferential statistics that in turn provided or failed to provide sufficient evidence to support the existence of each of the relationships in question. Multiple regression analysis as well as the choice of a pooled within bilingual correlation design was based upon recent literature identifying both the technique and design as superior to those employed in past bilingualism research (Diaz, 1985; Hakuta & Diaz, 1985; Hakuta, 1986; Reynolds, 1991).

Interpretation of Results

Three research questions posed to address the problem of the study were addressed via statistical inference tests conducted on corresponding null hypotheses. Each question will in turn be discussed as the findings relate to the empirical and theoretical basis of the study.

Research Question 1

The first research question, "Is there a statistically significant curvilinear relationship between bilingualism and critical thinking ability?" led to the following null hypothesis that was tested via computation of inferential statistics:

$$H_{01}: \quad P^2_{y(x_1, x_2, \dots, x_n)} = 0$$

$$H_{A\bar{I}}: \quad P_{x(x_1, x_2 = x_0)}^2 > 0$$

The findings failed to provide sufficient evidence to reject the null hypothesis and therefore it was concluded that there does not exist a statistically significant curvilinear relationship between bilingualism and critical thinking ability in baccalaureate nursing students.

The findings contradict those of Duncan and DeAvila (1979) who found a positive relationship between bilingualism and a field independent cognitive style, Bain (1974) and Liedtke and Nelson (1968) who found positive relationships between

bilingualism and concept formation, and Cummins (1978), Feldman and Shen (1971), and Ianco-Worrall (1972) who found positive relationships between bilingualism and metalinguistic awareness. One possible explanation for the failure to uncover sufficient evidence to support the existence of the relationship may be found in the constitutive and operational definitions of the critical thinking ability construct employed in the study. Although the formulation of a consensus conceptualization of the critical thinking construct and the recent availability of an instrument to measure it have significantly contributed to the research potential, the paucity of studies that have employed the consensus conceptualization and operationalization of the construct hinders attempts to conduct comparisons with the empirical research data base. This empirical data base includes findings supportive of positive relationships between bilingualism and concept formation, a field independent cognitive style, and metalinguistic awareness. Such findings were identified as providing support for the existence of the relationship between bilingualism and critical thinking ability inasmuch as they independently contributed to the consensus conceptualization of the critical thinking ability construct as defined in the study. Although the consensus definition is based in part upon such closely aligned factors, it--by the nature of being a consensus conceptualization--naturally includes other factors as well. It may be that the richness of the critical thinking construct and operationalization of it as a single score in the study, thus reflecting a more global measure of many constituent factors of which concept formation, a field independent cognitive style and metalinguistic awareness are closely aligned, actually conceals the existence of significant curvilinear

relationships between bilingualism and one or more of the constituent factors. It is therefore possible that the relationship between bilingualism and one or more of the constituent factors of critical thinking may be sufficiently supported by such findings but that the relationship between bilingualism and the more globally defined ability to think critically not be sufficiently supported.

In terms of the relationship between the findings and the theoretical underpinnings of the study, it is clear that the failure to uncover sufficient evidence to support the existence of a significant curvilinear relationship existing between bilingualism and critical thinking ability also fails to support the theories of Whorf (1956) and Vygotsky (1934/1962) and Cummins' (1979a) threshold hypothesis. More specifically, the weak form of Whorf's (1956) linguistic determinism theory that postulates the possibility that one's thought processes have a tendency to operate along different lines defined by their language and as such likely provide a bilingual a wider range of thought failed to receive support based on the findings of the study. Likewise, Vygotsky's (1934/1962) theory of the development of metalinguistic awareness as a result of the transition from *social speech* to *egocentric speech* failed to receive support based on the findings of the study. Cummins' (1979a) threshold hypothesis that was identified as the theoretical framework with which to examine the relationship between bilingualism and critical thinking ability in the study also failed to receive support. Specifically, the findings failed to provide sufficient evidence to support the existence of either a linear or polynomial relationship between the two constructs.

Findings corresponding to supplementary analysis did provide support to the existence of a significant relationship between first language (L_1) ability and critical thinking ability. This finding, although failing to support the theories of either Whorf (1956), Vygotsky (1934/1962), or Cummins (1976) does nevertheless lend some degree of support to the less well empirically established argument of Follman (1993). Follman (1993) has argued that ". . . critical thinking probably does not exist as a psychometrically established, unique construct separate from verbal ability" (p. 74). First language (L_1) was employed in the study solely as a means of controlling the confounding influence of general verbal ability on the examination of the relationship between bilingualism and critical thinking ability.

Research Question 2

The second research question, "Is there a statistically significant curvilinear relationship between bilingualism and critical thinking disposition?" led to the following null hypothesis that was tested via computation of inferential statistics:

$$H_{02}: \quad P_{\rho(x_1, x_2, \dots, x_7)}^2 = 0$$

$$H_{A2}: \quad P^2_{y(x_1, x_2, \dots, x_p)} > 0$$

The findings provided sufficient evidence to reject the null hypothesis; therefore, it was concluded that there does exist a statistically significant curvilinear

relationship between bilingualism and critical thinking disposition in baccalaureate nursing students.

These findings are consistent with those of Carringer (1974), Landry (1974), and Torrance, Gowan, Wu, and Aliotti (1970) that revealed significant relationships between bilingualism and divergent thinking skills, one of the key factors of the disposition to think critically. These findings are also consistent with those of Balkan (1970), Ben-Zeev (1977), Landry (1974), and Peal and Lambert (1962) that revealed significant relationships between bilingualism and cognitive flexibility, another key factor of the disposition to think critically.

It is clear that finding sufficient evidence to support the existence of a significant curvilinear relationship between bilingualism and critical thinking disposition supports the theories of Whorf (1956) and Cummins (1976). In terms of Whorf's (1956) linguistic relativism theory, the findings clearly lend greater support to the weak form of the theory in that language does not solely determine thought but instead contributes to shaping thought. It may be that the contribution of bilingualism to shaping thought is oriented primarily to shaping one's affect. It is important not to infer bilingualism as the causal factor in such a relationship however. In terms of the findings providing support to Cummins' (1979a) threshold hypothesis, it is essential to note that the relationship uncovered is perhaps best described as polynomial. The model employed in the analysis explored the existence of a polynomial relationship in that the relationship between degree of bilingualism and critical thinking disposition

was negative for lower levels of bilingualism and positive for higher levels of bilingualism. Cummins' (1979a) threshold hypothesis postulates the following:

The attainment of a lower threshold level of bilingual competence would be sufficient to avoid any negative cognitive effects; but the attainment of a second, higher, level of competence might be necessary to lead to accelerated cognitive growth. (p. 230)

As stated, the Cummins' (1979a) threshold hypothesis does not directly indicate the existence of a true *cup-up* polynomial fit of the regression plane to the data but instead simply indicates two slope transition points. It does however, postulate the cognitive effects associated with bilingualism to be negative below the *lower threshold* and positive above the *higher threshold*. Figure 3 illustrates the relationship between bilingualism and cognitive ability postulated by Diaz (1985) as the *new threshold hypothesis* in an attempt to reconcile the findings of his study that were inconsistent with Cummins' (1979a) threshold hypothesis.

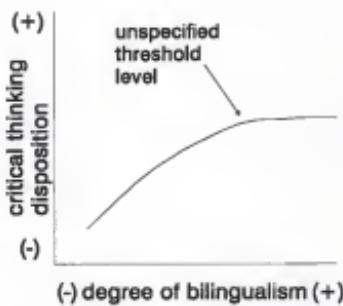


Figure 3 Relationship between bilingualism and critical thinking disposition predicted by Diaz's (1985) *new threshold hypothesis*.

Diaz's (1985) new threshold hypothesis postulates "degree of bilingualism will predict significant portions of cognitive variance only *before* a certain level of second-language proficiency has been achieved" (p. 1386). In elaborating further on his new threshold hypothesis, Diaz (1985) depicted the relationship as it appears in figure 3. Finally, figure 4 illustrates the relationship between bilingualism and critical thinking disposition supported by the findings of the present study.

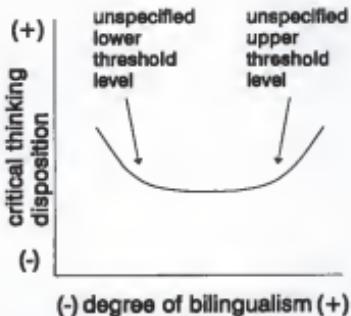


Figure 4 Relationship between bilingualism and critical thinking disposition as predicted by findings of present study.

The relationship uncovered in the study supports the existence of a negative relationship between low levels of bilingualism and critical thinking disposition and a positive relationship between high levels of bilingualism and critical thinking disposition as predicted by Cummins' (1979a) threshold hypothesis. The findings clearly provide support to Cummins' (1979a) threshold hypothesis and simultaneously provide opposition to Diaz's (1985) *new* threshold hypothesis.

Research Question 3

The third research question, "Is there a statistically significant relationship between critical thinking ability and critical thinking disposition?" led to the following null hypothesis that was tested via computation of inferential statistics:

$$H_{03}: P^2_{y(x_1 \cdot x_2 \dots x_8)} = 0$$

where: y = CCTST score (critical thinking ability)
 x_1 = CCTDI score (critical thinking disposition)
 $x_2 \dots x_8$ = all other factors in model

$$H_{A3}: P^2_{y(x_1 \cdot x_2 \dots x_8)} \neq 0$$

The findings failed to provide sufficient evidence to reject the null hypothesis; therefore, it was concluded that there does not exist a statistically significant relationship between critical thinking disposition and critical thinking ability in baccalaureate nursing students.

The findings will now in turn be related to both the empirical and theoretical underpinnings of the study. The findings contradict those of Berger (1984), that were identified as lending support to the theory of a relationship existing between critical thinking disposition and ability via Facione, Facione, and Sanchez's (1994b) componential description of professional judgment.

In terms of the relationship between the findings and the theoretical underpinnings of the study, it is clear that the failure to uncover sufficient evidence to support the existence of a significant relationship between critical thinking disposition and critical thinking ability also fails to support Lewin's (1935) theory of motivation.

More specifically, the relationship was predicted by the subjects' motivation to establish equilibrium between the disposition toward and the ability to think critically. Facione, Facione, and Sanchez (1994a) have argued that the need to establish equilibrium supports the notion that the relationship is most pronounced when the individual exhibits high levels both in their disposition toward and in their ability to think critically. The failure of the findings to provide sufficient support for the postulated relationship may be due in part to the relatively moderate critical thinking ability mean score. Facione, Facione and Sanchez (1994a) also argued that motivation theory supports the notion that until a minimal threshold of critical thinking ability is attained the relationship may not be apparent. It is therefore possible that the sample failed to reach the minimal threshold of critical thinking ability required to reveal a relationship between critical thinking disposition and critical thinking ability.

Supplemental Analyses

Supplementary inferential analysis conducted to confirm the necessity to appropriately control for concomitant factors that were added to the multiple regression model revealed findings supporting the existence of the following positive relationships:

1. Between subject age and critical thinking disposition.
2. Between subject cumulative grade point average and critical thinking disposition

3. Between subject primary language (L_1) and both critical thinking disposition and critical thinking ability.

These findings support the conclusion that in studies examining the relationships among bilingualism, critical thinking ability, and critical thinking disposition it is crucial to control the effects of age, cumulative grade point average, as well as first language (L_1) proficiency. Though there was not sufficient evidence to support gender and socioeconomic status as significant factors, they were retained in the model for the purpose of explaining variance that otherwise would have contributed as unexplained *error* variance.

Limitations of Study

It is essential to view the results, and implications drawn from this study in light of its limitations. The following are considered to be limitations of the study.

1. Numerous definitions of the key constructs of bilingualism and critical thinking ability have been proposed throughout the years. The findings of this study must therefore be viewed in light of the constitutive and operational definitions herein specified.
2. Use of a convenience sample limits the generalizability of the findings across subjects, settings, and times. In addition, since the percentage of the students eligible to participate in the study who actually participated differed among the four schools, caution is advised in generalizing the results across the participating schools.

3. The relationships among bilingualism, critical thinking ability, and critical thinking disposition are being measured and tested via correlations. Although correlations may be used to explore cause-and-effect relationships, the obtained results generally do not lead to strong conclusions. As Borg and Gall (1989) have pointed out, high correlation values may be due to the influence of a third variable or an artifact. Correlation coefficients are best used to measure the degree of relationship between two variables and to explore possible causal factors that may be tested at a later time (Borg & Gall, 1989).
4. Findings can be significant in two ways, statistically and practically. Although statistical significance is assessed through the use of statistical tests (e.g., *t*-test), Borg and Gall (1989) have argued "there is no simple answer to the problem of determining practical significance of research results" (p. 364). The practical significance of the relationships found to be statistically significant in the study is based in part upon the magnitude of the corresponding squared semipartial correlations.
5. Pending replication and extension, these findings should be evaluated cautiously so that, as Fishman (1977) warns "bilingualism will not be spuriously oversold now as it was spuriously undersold (or written off) in the past" (p. 38).
6. Studies based on a relatively small sample size that may be adequate for analysis purposes, fail to benefit from increased statistical power

corresponding to relatively larger sample sizes. The study necessarily employs a relatively large number of independent variables in the analysis and, although the sample size is adequate, a significant increase in sample size may have increased the statistical power enough for the findings to provide sufficient evidence in support of the existence of relationships that otherwise failed to be supported in the study.

7. Subjects involved in this study were tested for proficiency in both English and French. Replication and extension studies involving language combinations other than English and French may yield different results.

Implications for the Field of Education

In addition to the findings supporting or opposing the theories posited by Cummins (1979a), Vygotsky (1934/1962), and Whorf (1956), a number of implications for educational practice are evident. Such implications when confirmed through future research efforts are likely to enhance the practical application of the findings. The following are considered to be implications most relevant to the field of education.

In terms of implications for educational practice associated with the failure of the findings to provide sufficient evidence to support the postulated existence of a significant curvilinear relationship between bilingualism and critical thinking ability, it may be argued there is no reason to pursue either bilingualism as a predictor of critical thinking ability or critical thinking ability as a predictor of bilingualism. Likewise, in

terms of implications for educational practice associated with the failure of the findings to provide sufficient evidence in support of the theory of the existence of a significant relationship between critical thinking disposition and critical thinking ability, it may be argued that there is no reason to pursue either critical thinking disposition as a predictor of critical thinking ability or critical thinking ability as a predictor of critical thinking disposition.

The findings of the study did provide sufficient evidence in support of the existence of a significant curvilinear relationship between bilingualism and critical thinking disposition. This relationship has not been previously demonstrated to exist. The existence of such a relationship--especially as supported through replication and extension efforts--will clearly contribute in a practical way to future research efforts specifically aimed at achieving a better understanding of the cognitive and linguistic factors contributing to more effective baccalaureate nursing critical thinking instruction, curricula, and accreditation criteria. The benefits associated with critical thinking ability are only realized in those who are disposed toward engaging in critical thinking. Hence, the significance of the practical contribution can perhaps best be realized through an appreciation of the value our society has placed on the ability to think critically (Dressel, 1955; National Commission on Excellence in Education, 1983; National Institute of Education, 1984; Newman, 1985). The nursing discipline in particular has embraced critical thinking ability as a characteristic essential to sound professional nursing practice. Although the NLN's accreditation criteria for critical thinking instruction are currently defined in only very general terms, it is likely their

definition will evolve to become more specific. Enhanced criterion specificity will be made possible, in part, through a better understanding of the relationship between bilingualism and critical thinking disposition of baccalaureate nursing students. The enhancement of accreditation criteria will likely contribute in turn to the development of better baccalaureate nursing curricula.

Many education scholars have argued that instructional effectiveness may be increased via a better understanding of the characteristics that each learner presents to the instructional setting. Conversely, instructional effectiveness may diminish when important learner characteristics are ignored by the instructional designer. How an individual seeks meaning is likely to be influenced by the culture in which the person has been brought up. In light of such a view, it is easier to imagine how attention to learner characteristics as part of the instructional design process can dramatically influence the effectiveness of critical thinking instruction. Many educators today justifiably view with great skepticism the effectiveness of critical thinking instruction. Failure to consider essential learner characteristics may have contributed to the mixed findings of many of the studies that have attempted to determine the effectiveness of various forms of critical thinking instruction incorporated into baccalaureate nursing curricula (Keller, 1993). The demonstration of the existence of sufficient evidence to support the postulated existence of a significant curvilinear relationship between bilingualism and critical thinking disposition combined with the necessity of recognizing and attending to learner characteristics in the instructional design process as a prerequisite to maximizing instructional effectiveness has clear implications for

improving--through future research efforts--baccalaureate nursing program critical thinking instruction.

Facione, Sanchez, Facione, and Gainen (1995) have argued that there is a characterological profile related to critical thinking disposition and that it has been supported as an essential educational goal. According to Facione, Sanchez, Facione, and Gainen (1995) "there is a broad consensus among CT [critical thinking] theoreticians that the educational goal is to prepare persons, particularly at the college level, who willingly and skillfully engage in CT" (p. 2). They continue by arguing "there is a growing consensus that a complete approach to developing college students into good critical thinkers must include the nurturing of the disposition toward CT" (p. 4). Although the findings of the study failed to provide sufficient evidence in support of a relationship between critical thinking disposition and critical thinking ability, the implications which may be drawn from the findings that support a relationship between bilingualism and critical thinking disposition are clear. Future research efforts aimed at furthering an understanding of the relationship between bilingualism and critical thinking disposition will likely contribute in practical ways to more effective nurturing of the critical thinking disposition of baccalaureate nursing students and perhaps of a larger scholastic population to engage in critical thinking. As recounted by Facione, Sanchez, Facione, and Gainen (1995), the significance of the disposition to engage in critical thinking has perhaps best been expressed by John Dewey (1933), who wrote:

If we were compelled to make a choice between these personal attributes and knowledge about the principles of logical reasoning together with

some degree of technical skill in manipulating special logical processes, we should decide for the former. (p. 34)

Recommendations for Further Research

It is clear that more research is needed in order to better understand the precise nature of the relationships among bilingualism, critical thinking ability, and critical thinking disposition and the role such relationships play in influencing instructional effectiveness, particularly of critical thinking instruction.

In addition to this general recommendation for further research, several suggestions for further research can be made based upon the findings of the study.

1. Similar studies should be conducted to replicate and extend the study particularly to examine relationships among the constructs as they evolve over time. The focus of such studies should be on further explicating the causal component(s) of the relationships.
2. Similar studies should be conducted which incorporate random sampling across schools so that results can be more appropriately generalized to the entire population of baccalaureate nursing students.
3. Similar studies should be conducted to identify other characteristics of baccalaureate nursing students that relate to their critical thinking ability and critical thinking disposition.
4. Follow-up studies should be conducted to explore the influence such relationships have on the effectiveness of critical thinking instruction.

5. Similar studies should be conducted to examine the relationships among bilingualism, critical thinking ability, and the critical thinking disposition of associate nursing students.
6. Further research should be conducted to examine relationships among bilingualism, critical thinking ability, and critical thinking disposition of subjects exhibiting similar levels of language proficiency in language combinations other than French and English. For example, French/Italian are commonly considered closely related while French/nonRomantic language are commonly considered more distally related. It would be expected that differential effects will be uncovered with the degree of similarity between a bilingual's two languages playing a mediating role in relationships among bilingualism, critical thinking ability, and critical thinking disposition.
7. Further research should be conducted to explore the relationships among bilingualism, critical thinking ability, and the critical thinking disposition of both younger and older subpopulations.
8. Further research should be conducted to explore the influence that the methodology employed to learn a second language has on relationships among bilingualism, critical thinking ability, and critical thinking disposition. Such research should be aimed at determining whether relationships exist as a result of the bilinguals' present access to two languages or as a result of their bilingual learning experiences.

In summary, the present study's findings support the existence of a relationship between bilingualism and critical thinking disposition of baccalaureate nursing students. Further research studies should replicate and extend the exploration of the nature of the relationship between bilingualism and critical thinking disposition particularly across populations over time. Finally, further research studies should explore the influence on instructional effectiveness that bilingualism, critical thinking ability, and critical thinking disposition have as learner characteristics.

APPENDIX 1
DEMOGRAPHIC DATA QUESTIONNAIRE

DEMOGRAPHIC DATA QUESTIONNAIRE

STUDENT ID NUMBER: _____

The information obtained through this questionnaire will remain confidential and will not be disclosed to anyone. Group results only may be published in the form of a dissertation and possibly in educational research journals. Please respond as completely as possible to each of the following questions by either filling in the blank space or circling the best response. Remember that although you are encouraged to answer each question, you do not have to answer any question you do not wish to answer.

- | | |
|---|---|
| 1. Gender: | M / F |
| 2. Age: | _____ |
| 3. Current cumulative grade point average (GPA): | _____ |
| 4. Which job category does your father's occupation best fall into? | |
| a. Unemployed | c. White collar/Professional |
| b. Blue collar | d. Top level executive |
| 5. What is the highest educational level attained by your father? | |
| a. Elementary (K-8) | c. Post-secondary (college freshman-senior level) |
| b. Secondary (9-12) | d. Graduate (beyond college senior level) |
| 6. Which job category does your mother's occupation best fall into? | |
| a. Unemployed | c. White collar/Professional |
| b. Blue collar | d. Top level executive |
| 7. What is the highest educational level attained by your mother? | |
| a. Elementary (K-8) | c. Post-secondary (college freshman-senior level) |
| b. Secondary (9-12) | d. Graduate (beyond college senior level) |
| 8. Which of the following best describes your parent's annual income level? | |
| a. Poverty income level | c. High-middle income level |
| b. Low-middle income level | d. High income level |
| 9. Which job category does your occupation best fall into? | |
| a. Unemployed | c. White collar/Professional |
| b. Blue collar | d. Top level executive |
| 10. What is the highest educational level attained by yourself? | |
| a. Elementary (K-8) | c. Post-secondary (college freshman-senior level) |
| b. Secondary (9-12) | d. Graduate (beyond college senior level) |

11. Which of the following best describes your annual income level?
- a. Poverty income level c. High-middle income level
 - b. Low-middle income level d. High income level

APPENDIX 2
C-TEST ENGLISH VERSION

C-TEST English Version

STUDENT ID NUMBER: _____

Instructions:

In the following paragraphs you will find that approximately every other word is incomplete. You are to read the whole paragraph and then attempt to fill the blanks to restore the text. Please be sure to spell each word correctly as incorrectly spelled words will be marked wrong. Be sure to clearly print your responses in the blank spaces provided. If you are not sure about an answer, guess. Now, for each of the following paragraphs, read the paragraph through and when you are finished reading, fill in the blanks to restore the text as instructed.

Paragraph E1

One cool autumn evening, Bob L., a young professional, returned home from a trip to the supermarket to find his computer gone. Gone! all so____ of cr____ thoughts ra____ through h____ mind: H____ it be____ stolen? H____ it be____ kidnapped? H____ searched h____ house f____ a cl____ until h____ noticed a sm____ piece o____ printout pa____ stuck un____ a mag____ on h____ refrigerator do_____. His he____ sank a____ he re____ this sim____ message:
CAN'T CONTINUE, FILE CLOSED, BYE.

Paragraph E2

There is a third factor besides farming and herding in the spread of man-made deserts: deforestation. The progre_____ destruction o_____ the Th_____ World's st_____ of tr_____ is dama_____ not on_____ in d_____ regions; every_____ it occ_____it c_____ accelerate t_____ decay o_____ the so_____ and red_____ its capa_____ to fe_____ people. It can reduce rainfall and lead to drought.

Paragraph E3

There are certain things which no student can do without and others which may not be as necessary as you thought. It m_____ be wo_____ considering so_____ small hi_____. You m_____ find your_____ in ne_____ of elect____ appliances su_____ as li____ bulbs, adap____ or pl_____. These c_____ be obta_____ from ma_____ places. GILL i_____ a go_____ hardware sh_____ and try____ to fi_____ it i_____ a chal_____. It is hidden in a little alley leading off High Street called Wheatsheaf Yard.

Answer Key for C-TEST (English Version)Paragraph E1

One cool autumn evening, Bob L., a young professional, returned home from a trip to the supermarket to find his computer gone. Gone! all sorts of crazy thoughts raced through his mind: Had it been stolen? Had it been kidnapped? He searched his house for a clue until he noticed a small piece of printout paper stuck under a magnet on his refrigerator door. His heart sank as he read this simple message:
CAN'T CONTINUE, FILE CLOSED, BYE.

Paragraph E2

There is a third factor besides farming and herding in the spread of man-made deserts: deforestation. The progressive destruction of the Third World's stock of trees is damaging not only in dry regions; everywhere it occurs it can accelerate the decay of the soil and reduce its capacity to feed people. It can reduce rainfall and lead to drought.

Paragraph E3

There are certain things which no student can do without and others which may not be as necessary as you thought. It may be worth considering some small hints. You may find yourself in need of electrical appliances such as light bulbs, adaptors or plugs. These can be obtained from many places. GILL is a good hardware shop and trying to find it is a challenge. It is hidden in a little alley leading off High Street called Wheatsheaf Yard.

APPENDIX 3
C-TEST FRENCH VERSION

STUDENT ID NUMBER: _____

Instructions:

In the following paragraphs you will find that approximately every other word is incomplete. You are to read the whole paragraph and then attempt to fill the blanks to restore the text. Please be sure to spell each word correctly as incorrectly spelled words will be marked wrong. Be sure to clearly print your responses in the blank spaces provided. If you are not sure about an answer, guess. Now, for each of the following paragraphs, read the paragraph through and when you are finished reading, fill in the blanks to restore the text as instructed.

Paragraph F1

Dans la fraîcheur d'une soirée d'automne, Bob L., un jeune homme sérieux, est rentré chez lui après un voyage au supermarché pour découvrir que son ordinateur avait disparu. Disparu! toute so____ d'idées fol____ lui o____ traversé l'es____: A-t-il é____ volé? A-t____ été kidn____? Il ____ fouillé s____ maison e____ _ quête d____ quelque tr____ jusqu'à c____ qu'il rema____ un pe____ morceau d____ papier imp____ coincé so____ un pe____ objet aim____ sur l____ porte d____ son réfrig_____. Son cœ____ s'est se____ à l____ lecture d____ ce mes____ simple: IMPOSSIBLE DE CONTINUER, FICHIER FERMÉ, AU REVOIR.

Paragraph F2

En outre de l'agriculture et de l'élevage, il existe un troisième facteur de la progression des déserts artificiels: le déboisement. La destr_____ progressive d_____ stock d'ar_____ du Ti_____ Monde n'e_____ pas nuis_____ uniquement a_____ régions séc_____. Partout o_____ cela s_____ produit, ce_____ peut accé_____ la dégra_____. du s_____ et réd_____. sa capa_____. de nou_____. les hom_____. Cela peut réduire la hauteur des précipitations et amener la sécheresse.

Paragraph F3

Il y a certaines choses dont aucun étudiant ne peut se passer et d'autres qui ne sont peut-être pas aussi nécessaires que vous le pensiez. Cela vaud_____. la pe_____. de consi_____. quelques pet_____. suggestions. Vo_____. pourriez av_____. besoin d'appa_____. électriques p_____. exemple d'amp_____. adaptateurs, pri_____. On pe_____. se proc_____. tout ce_____. dans plus_____. endroits. GILL e_____. une bo_____. quincaillerie e_____. c'est u_____. vrai pa_____. que d'ess_____. de l_____. trouver. Elle se cache dans une petite ruelle qui débouche sur High Street et qui s'appelle Wheatsheaf Yard.

Answer Key for C-TEST (French Version)Paragraph F1

Dans la fraîcheur d'une soirée d'automne, Bob L., un jeune homme sérieux, est rentré chez lui après un voyage au supermarché pour découvrir que son ordinateur avait disparu. Disparu! toute sorte d'idées folles lui ont traversé l'esprit : A-t-il été volé? A-t-il été kidnappé? Il a fouillé sa maison en quête de quelque trace jusqu'à ce qu'il remarque un petit morceau de papier imprimé coincé sous un petit objet aimanté sur la porte de son réfrigérateur. Son cœur s'est serré à la lecture de ce message simple: IMPOSSIBLE DE CONTINUER, FICHIER FERMÉ, AU REVOIR.

Paragraph F2

En outre de l'agriculture et de l'élevage, il existe un troisième facteur de la progression des déserts artificiels: le déboisement. La destruction progressive du stock d'arbres du Tiers Monde n'est pas nuisible uniquement aux régions sèches. Partout où cela se produit, cela peut accélérer la dégradation du sol et réduire sa capacité de nourrir les hommes. Cela peut réduire la hauteur des précipitations et amener la sécheresse.

Paragraph F3

Il y a certaines choses dont aucun étudiant ne peut se passer et d'autres qui ne sont peut-être pas aussi nécessaires que vous le pensiez. Cela vaudrait la peine de considérer quelques petites suggestions. Vous pourriez avoir besoin d'appareils électriques par exemple d'ampoules, adaptateurs, prises. On peut se procurer tout cela dans plusieurs endroits. GILL est une bonne quincaillerie et c'est un vrai pari que d'essayer de la trouver. Elle se cache dans une petite ruelle qui débouche sur High Street et qui s'appelle Wheatsheaf Yard.

APPENDIX 4
REQUEST FOR STUDY RESULTS

REQUEST FOR STUDY RESULTS

I hereby request a copy of the results of the study be sent to me at the following address:

NAME: _____

ADDRESS: _____

REFERENCES

- Bain, B. (1974). Bilingualism and cognition: Toward a general theory. In S. T. Carey (Ed.), Bilingualism, biculturalism, and education: Proceedings from the conference at College Universitaire Saint Jean (pp. 119-128). Edmonton: University of Alberta.
- Baker, C. (1988). Key issues in bilingualism and bilingual education. Clevedon, Avon: Multilingual Matters.
- Balkan, L. (1970). Les effets du bilinguisme français-anglais sur les aptitudes intellectuelles. Brussels: International Association for the Study and Promotion of Audio-Visual and Structuro-Global Methods.
- Barke, E. M., & Perry-Williams, D. E. (1938). A further study of the comparative intelligence of children in certain bilingual and monoglot schools in South Wales. British Journal of Educational Psychology, 8, 63-77.
- Ben-Zeev, S. (1977). The influence of bilingualism on cognitive strategy and cognitive development. Child Development, 48, 1009-1018.
- Borg, W. R., & Gall, M. D. (1989). Educational research: An introduction (5th ed.). White Plains, NY: Longman.
- Bruner, J. S. (1973). Beyond the information given. New York, NY: W. W. Norton & Company.
- Bruner, J. S. (1975). Language as an instrument of thought. In A. Davies (Ed.), Problems of language and learning (pp. 61-68). London, England: Heinemann.
- Carringer, D. C. (1974). Creative thinking abilities of Mexican youth: The relationship to bilingualism. Journal of Cross-Cultural Psychology, 5, 493-504.
- Carroll, J. B. (1987). Review of "C-Tests in der Praxis" [Review of the book C-Tests in der Praxis]. Language Testing, 4, 99-106.
- Carow, S. M. A. (1957). Linguistic functioning of bilingual and monolingual children. Journal of Speech and Hearing Disorders, 22, 371-380.

- Chapelle, C. A., & Abraham, R. G. (1990). Cloze method: What difference does it make? Language Testing, 7(2), 121-146.
- Chomsky, N. (1975) Reflections on language. New York, NY: Pantheon Books.
- Cohen, J., & Cohen, P. (1983) Applied multiple regression/correlation analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ.: L. Erlbaum Associates.
- Cummins, J. (1976). The influence of bilingualism on cognitive growth: A synthesis of research findings and explanatory hypotheses. Working Papers on Bilingualism, 9, 1-43. Toronto, Ontario: Ontario Institute for Studies in Education.
- Cummins, J. (1978). Metalinguistic development of children in bilingual education programs: Data from Irish and Canadian Ukrainian-English programs. In M. Paradis (Ed.), Aspects of Bilingualism (pp. 127-138). Columbia, SC: Hornbeam Press.
- Cummins, J. (1979a). Linguistic interdependence and the educational development of bilingual children. Review of Educational Research, 49(2), 222-251.
- Cummins, J. (1979b). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. Working Papers on Bilingualism, 19, 121-129. Toronto, Ontario: Ontario Institute for Studies in Education. (ERIC Document Reproduction Service No. ED 184 334)
- Cummins, J. (1981). The role of primary language development in promoting educational success for language minority students. In California State Department of Education, Schooling and language minority students: A Theoretical Framework (pp. 3-49). Los Angeles: Evaluation, Dissemination and Assessment Center. (ERIC Document Reproduction Service No. ED 249 773)
- Cummins, J. (1985). Bilingualism and special education: Issues in assessment and pedagogy. San Diego, CA: College-Hill Press.
- Dewey, J. (1933). How we think: A restatement of the relation of reflective thinking to the educational process. Lexington, MA: Heath.
- Diaz, R. M. (1983). Thought and two languages: The impact of bilingualism on cognitive development. In E. W. Gordon (Ed.), Review of research in education (Vol. 10, pp. 23-54). Washington, DC: American Educational Research Association.
- Diaz, R. M. (1985). Bilingual cognitive development: Addressing three gaps in current research. Child Development, 56, 1376-1388.

- Dornyei, Z., & Katona, L. (1993). Validation of the C-Test amongst Hungarian EFL learners. Language Testing, 9(2), 187-206.
- Dressel, P. (1955). Critical thinking: The goal of education. National Education Association Journal, 44, 418-420.
- Duncan, S. E., & DeAvila, E. A. (1979). Bilingualism and cognition: Some recent findings. NABE Journal, 4, 15-50.
- Facione, P. A. (1990). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations. (ERIC Document Reproduction Service No. ED 315 423)
- Facione, P. A., & Facione, N. C. (1994). The California Critical Thinking Skills Test-Test manual. Millbrae, CA: California Academic Press.
- Facione, P. A., Facione, N. C., & Sanchez, C. A. (1994a). The California Critical Thinking Disposition Inventory-Test manual. Millbrae, CA: California Academic Press.
- Facione, P. A., Sanchez, C. A., & Facione, N. C. (1994b). Are college students disposed to think? Millbrae, CA: California Academic Press. (ERIC Document Reproduction Service No. ED 368 311)
- Facione, P. A., Sanchez, C. A., Facione, N. C., & Gainen J. (1995). The disposition toward critical thinking. The Journal of General Education, 44(1), 1-25.
- Feldman, C., & Shen, M. (1971). Some language-related cognitive advantages of bilingual five-year-olds. The Journal of Genetic Psychology, 118, 235-244.
- Fishman, J. A. (1977). The social science perspective. In Bilingual education: Current perspectives, Vol. 1. Social science (pp. 1-49). Arlington, VA: Center for Applied Linguistics.
- Follman, J. (1987). Teaching of critical thinking/thinking-Promises! promises! Informal Logic, 9(2&3), 131-140.
- Follman, J. (1993). Critical thinking and verbal ability. ACEHI Journal, 19, 71-76.
- Frederickson, K., & Mayer, G. G. (1977). Problem-solving skills: What effect does education have? American Journal of Nursing, 77, 1167-1169.

- Gross, Y. T., Takazawa, E. S., & Rose, C. L. (1987). Critical thinking and nursing education. *Journal of Nursing Education*, 26, 317-323.
- Gunning, C. S. (1981). Relationships among field independence, critical thinking ability, and clinical problem-solving ability of baccalaureate nursing students (Doctoral dissertation, University of Texas at Austin, 1981). *Dissertation Abstracts International*, 42(07), B2780.
- Hakuta, K. (1986). *Mirror of language: The debate on bilingualism*. New York, NY: Basic Books, Inc.
- Hakuta, K., & Diaz, R. M. (1985). The relationship between degree of bilingualism and cognitive ability: A critical discussion and some new longitudinal data. In K. E. Nelson (Ed.), *Children's language*, Vol. 5. (pp. 319-344). Hillsdale, NJ: Lawrence Erlbaum Associated.
- Hakuta, K., Ferdman, B. M., & Diaz, R. M. (1986). *Bilingualism and cognitive development: Three perspectives and methodological implications*. Los Angeles, CA: University of California Center for Language Education and Research. (ERIC Document Reproduction Service No. ED 278 274)
- Harris, C. W. (1948). An exploration of language skill patterns. *Journal of Educational Psychology*, 32, 351-364.
- Harris, D. P. (1969). *Testing English as a second language*. New York, NY: McGraw Hill.
- Hughes, A. (1989). *Testing for language teachers*. Cambridge, England: Cambridge University Press.
- Ianco-Worrall, A. (1972). Bilingualism and cognitive development. *Child Development*, 43, 1390-1400.
- Keller, R. (1993). Effects of an instructional program on critical thinking and clinical decision-making skills of associate degree nursing students (Doctoral dissertation, University of South Florida, 1993). *Dissertation Abstracts International*, 54(06), B2941.
- Kessler, C., & Quinn, M. E. (1982). Cognitive development in bilingual environments. In B. Hartford, A. Valdman, & C. R. Foster (Eds.), *Issues in international bilingual education: The role of vernacular* (pp. 53-79). New York, NY: Plenum.

Kintgen-Andrews, J. (1988). Development of critical thinking: Career ladder P.N. and A.D. nursing students, pre-health science freshman, generic baccalaureate sophomore nursing students. Resources in Education, 24(1), 1-45. (ERIC Document Reproduction Service No. ED 297 153)

Klein-Braley, C., & Raatz, U. (1984). A survey of research on the C-Test. Language Testing, 1, 134-146.

Klein-Braley, C. (1985). A cloze-up on the C-Test: A study in the construct validation of authentic tests. Language Testing, 2, 76-104.

Landry, R. G. (1974). A comparison of second language learners and monolinguals on divergent thinking tasks at the elementary school level. The Modern Language Journal, 58, 10-15.

Leopold, W. F. (1949). Speech development of a bilingual child: A linguist's record, Vol. 3. Grammar and general problems. Evanston, IL: Northwestern University Press.

Lewin, K. (1935). A dynamic theory of personality: Select papers (D. K. Adams & K. E. Zener, Trans.). New York, NY: McGraw Hill.

Liedtke, W. W., & Nelson, L. D. (1968). Concept formation and bilingualism. Alberta Journal of Educational Research, 14, 225-232.

Lynch, M. H. (1989). Critical Thinking: A comparative study of baccalaureate and associate degree nursing students (Doctoral dissertation, Peabody College of Teachers of Vanderbilt University, TN, 1989). Dissertation Abstracts International, 49(08), A2157.

MacLaughlin, B. (1984). Second-language acquisition in childhood: Vol. 1. Preschool children. Hillsdale, NJ: Lawrence Erlbaum Associates.

MacLaughlin, B. (1985). Second-language acquisition in childhood: Vol. 2. School age children. Hillsdale, NJ: Lawrence Erlbaum Associates.

Macnab, G. L. (1979). Cognition and bilingualism: A reanalysis of studies. Linguistics, 17, 231-255.

Macnamara, J. (1966). Bilingualism and primary education: A study of Irish experience. Edinburgh, Scotland: Edinburgh University Press.

Mullally, L. J. (1979). Educational cognitive style: Implications for instruction. Theory into Practice, 16(4), 238-242.

National Commission on Excellence in Education (1983). A nation at risk: The imperative for educational reform. Washington, DC: U.S. Government Printing Office.

National Institute of Education (1984). Involvement in learning: Realizing the potential of American higher education. Washington, DC: U.S. Government Printing Office.

Newman, F. (1985). Higher education and the American resurgence. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Oller, J. W. Jr. (1973). Cloze tests of second language proficiency and what they measure. Language Learning, 23(1), 105-118.

Paivio, A., & Desrochers, A. (1980). A dual-coding approach to bilingual memory. Canadian Journal of Psychology, 34, 390-401.

Paivio, A. (1991). Mental representation in bilinguals. In A. G. Reynolds (Ed.), Bilingualism, multiculturalism, and second language learning (pp. 113-126). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Peal, E., & Lambert, W. (1962). The relation of bilingualism to intelligence. Psychological Monographs, 76(546), 1-23.

Quellmalz, E. (1984). Designing an integrated instructional and assessment system for critical thinking skills. Paper presented at the meeting of the American Educational Research Association, Montreal, Canada. (ERIC Document Reproduction Service No. ED 249 589)

Reynolds, A. G. (1991). Bilingualism, multiculturalism, and second language learning. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Rust, V. I., Jones, R. S., & Kaiser, H. F. (1962). A factor-analytic study of critical thinking. The Journal of Educational Research, 55(6), 253-259.

Saer, D. J. (1923). The effects of bilingualism on intelligence. British Journal of Psychology, 14, 25-38.

SAS Institute. (1989). Statistical analysis system, Release 6.07 [Computer Program]. Cary, NC: Author.

Segalowitz, N. (1977). Psychological perspectives on bilingual education. In B. Spolsky & R. Cooper (Eds.), Frontiers of bilingual education (pp. 119-158). Rowley, MA: Newbury House.

- Smith, D. (1977). College classroom instructions and critical thinking. Journal of Educational Psychology, 69(2), 180-190.
- Sternberg, R., & Bhana, K. (1986). Synthesis of research on the effectiveness of intellectual skills programs: Snakeoil remedies or miracle cures? Educational Leadership, 44(2), 60-67.
- Sweeney, S. L. (1993). Critical thinking abilities of practicing nurses with varying years of experience, educational preparation, and clinical proficiency (Master's thesis, University of Florida, 1993). Masters Abstracts International, 33(02), 0519.
- Taylor, W. (1953). "Cloze procedure": A new tool for measuring readability. Journalism Quarterly, 30, 415-438.
- Tiessen, J. B. (1987). Critical thinking and selected correlates among baccalaureate nursing students. Journal of Professional Nursing, 3(2), 118-124.
- Torrance, E. P., Gowan, J. C., Wu, J. M., & Aliotti, N. C. (1970). Creative functioning of monolingual and bilingual children in Singapore. Journal of Educational Psychology, 61, 72-75.
- Toukomaa, P., & Skutnabb-Kangas, T. (1977). The intensive teaching of the mother tongue to migrant children of pre-school age and children in the lower level of comprehensive school. Helsinki, Finland: The Finnish National Commission for UNESCO.
- Vygotsky, L. S. (1962). Thought and language (E. Hanfmann & G. Vakar, Eds. and Trans.). Cambridge, MA: MIT Press. (Original work published 1934)
- Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.
- Watson, G., & Glaser, E. M. (1980). Watson-Glaser critical thinking appraisal manual. New York, NY: Harcourt, Brace & Javonovich, Inc.
- Whorf, B. J. (1956). Language, thought and reality: Selected writings of Benjamin Lee Whorf (J.B. Carroll, Ed.). Cambridge, MA: MIT Press.

BIOGRAPHICAL SKETCH

Raymond Theodore Albert was born on May 25, 1961, to Fernand Raymond Albert and Rita Ursula Albert in Washington, D.C. He was married July 5, 1986, to Rachel Ellen Raymond. His daughter Alexandra Ellen was born April 13, 1988, and son Samuel Theodore was born December 16, 1992. He graduated from Fort Kent Community High School, Fort Kent, Maine, in 1979.

After receiving his Bachelor of Arts degree from the University of Maine at Fort Kent in 1983, he attended the University of Vermont, Burlington, and earned a Master of Science degree in computer science in 1986. During his studies he was employed as a software engineer/programmer at Macro Systems Inc., Burlington, Vermont, and received several teaching fellowships from the University of Vermont. He also received a Pinkham Family Trust Fund Scholarship. Shortly, thereafter, he returned to his hometown and was employed by the University of Maine at Fort Kent as an instructor of computer applications and became the sole proprietor of a computer consulting business, CompuSolve.

In 1989, he took an educational leave of absence due to his wife attending graduate school at the University of Texas, Health Science Center, in Houston, Texas, where he became employed in June of 1989 as a software quality engineer for NASA based out of Johnson Space Center. In September of 1990, both he and his family

returned to Eagle Lake, Maine, where he resumed his position at the University of Maine at Fort Kent as an assistant professor of computer science.

He entered the University of Florida College of Education Doctor of Philosophy program in May, 1993, concentrating on curriculum and instruction, educational media, and instructional design with a computer science cognate and received a bilingual/multicultural education fellowship sponsored by the United States Office of Bilingual Education and Minority Language Affairs. He was inducted into the Phi Delta Kappa National Education Honor Society in January, 1994. He was also employed during his studies as an adjunct professor of computer information systems at Santa Fe Community College, Gainesville, Florida, as well as a graduate teaching assistant at the University of Florida Office of Instructional Resources in Gainesville.

After completion of his course work and being admitted to candidacy for the Ph.D. in curriculum and instruction, he returned to his position as an assistant professor of computer science at the University of Maine at Fort Kent. His creative works are numerous and include development of the following: PAC-MAINE, a software application designed to address the Maine state governor's request for innovative methods for raising students' educational aspirations within the state of Maine; University of Maine System/Interactive Television System Integration Prototype to integrate and improve testing, evaluation, and grading via the interactive television system of Maine; Online Faculty Evaluation Tool (OFACET) prototype to address confidentiality and student/faculty concerns over the instructor/course evaluations process; and Graduate Record Exam Word Study software to assist the

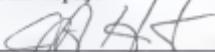
University of Maine at Fort Kent undergraduate community in preparation for the verbal component of the Graduate Record Exam.

He has presented at numerous national and local conferences related to computers and technology in education. He was awarded multiple Annenberg/CPB (Corporation for Public Broadcasting) grants in support of his UMS/ITV System Integration Prototype development efforts. He continues to be an active member of numerous professional organizations. He was awarded the Ph.D. degree in curriculum and instruction from the College of Education at the University of Florida in December, 1996.

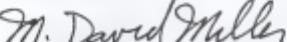
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Lee J. Mullally, Chair
Associate Professor of Instruction
and Curriculum

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Jeffry A. Hurt
Associate Professor of Instruction
and Curriculum

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


M. David Miller
Professor of Foundations of
Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


C. Arthur Sandeen
Professor of Educational
Leadership

This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December 1996


Patrick J. McDowell
Dean, College of Education

Dean, Graduate School

LD
1780
1996
.A325

UNIVERSITY OF FLORIDA



3 1262 08554 9755